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Registration is Vexation

AS each annual meeting of the National Register of Electrical Installation Contractors comes round, the questions arise: What are the objects of the Register? And are these objects being achieved?

The principal ostensible object is to protect the public from defective installation work. This is not altruism, for good contractors realise that if they can get together and effectively impress upon the public that registration is a guarantee of good materials and workmanship, they will ultimately reap their full reward.

We have repeatedly pointed out that if the public is to be protected, it must be acquainted with the Register and what it stands for. Yet very few people outside the electrical industry (to say no more!) have ever heard of it. The Register itself has little money to spend on publicity and it is only in the very small number of districts in which enterprising registered contractors have got together to advertise themselves that anything has been done in this way.

There are 370 local authority undertakings in Great Britain and twenty-three of them recognise the Register. It cannot be said that the others are not aware of the Register's existence; therefore they either consider it ineffective or are not too particular about the class of wiring which they connect up. Some, of course, have their own lists of recognised local contractors.

That brings us to the question of the efficacy of the Register as regards the registered themselves.

The qualifications demanded of candidates for registration are not too high (some critics say that the conditions are not severe enough). This means that an eye must be kept on many registered contractors to ensure that their work does not fall below the prescribed standard. Thus continuous inspection by the registration authority is essential.

The Register was instituted eleven years ago and up to date two inspectors have been appointed, but what are they among so many?—the total number on the Register stands at over 1,700. Yet these two are as many as the present income will allow. Will it ever be possible to employ, say, half a dozen, probably the minimum number required? Six inspectors by working full time could just about pay one visit a year to each of the present number of contractors on the Register.

Last year, the work of 339 contractors (including 117 applicants for registration) was examined by the two existing inspectors, one of whom was appointed during the year. Their report shows that faulty work was due generally to ignorance of proper wiring practice or to inadequate supervision. It seems strange that contractors accepted for registration should not be acquainted with the nature of good installation.

Both these shortcomings are probably due to the employment of unskilled labour and the Executive Committee of the Register appears to recognise this when it suggests the calling of a conference to discuss the registration of operatives, as distinct from their employers.

This has long been one of the aims of the Electrical Contractors' Association, and the Electrical Trades Union is said to regard the matter with favour, but it means legislation to secure an effective scheme.

But should not any compulsory scheme for operatives be accompanied, or preceded, by the statutory registration of the employers? As this has been advocated for so long already, does the Executive Committee's proposal take us any farther along the road to guaranteed installation work?

The history of the National Register seems to indicate in no uncertain manner that a purely voluntary scheme cannot be successful. All the time that there are more contractors (reputable and otherwise) who refuse to be registered than there are on the Register, the movement suffers under a too-heavy handicap.

It seems to us that any conference which may be called to deal with the registration of wiremen will be compelled to take the whole of the installation business into consideration.

Liverpool Street

As the Faraday Lecture is intended to be a semi-popular exposition of electrical development, it is a pity that so few non-members of the Institution of Electrical Engineers were present to hear its delivery in London. The strong criticism passed by Professor W. Marchant on the reactionary attitude adopted by the L.N.E.R. towards suburban and semi-suburban electrification should have reached a far wider public. His views are quite in accord with those expressed by Sir Philip Dawson in this issue. As Professor Marchant pointed out, the arguments advanced against the electrification of the system converging upon Liverpool Street were used many years ago in connection with the conversion of the East London Railway. Yet the beneficial results of electrifying that line are as apparent to-day as they are in the case of the Southern Railway. That the rapid acceleration possible with electric traction (even ignoring its other advantages) provides the only practicable means of transporting urban workers to their homes outside the towns is no longer a matter for debate. Let us hope that the L.N.E.R. Co. will soon overcome its unwarranted fears.

Don't Miss the Fair

FIRST the Fair and then the Convention! This is how the two great events stand in order of date, and from the purely electrical trade point of view it correctly represents also their relative importance. Not that we have any wish to let the Bournemouth gathering take second place so far as electricity supply, the industry as a whole, and the profession are concerned; but one hears rumours that, as the two events are so close together, some people may give the Fair the go-by this year. There is really no reason why this should be so, for a visit to Birmingham during the first week will leave plenty of time for busy men to do a spot of work at the office before getting away to Bournemouth. Many electrical men have thought little in the past of "doing" both the I.M.E.A. and the E.C.A. meetings. While, naturally, there will be a good deal of domestic electrical apparatus exhibited at both places, the Fair at Birmingham will, as usual, bring together a large variety of other products interesting to the technical man, the supply man, and the trader alike. As we have stated here already, both 1935 arrangements are more or less experimental, and we hope that both experiments will succeed.

A.E.I. Progress

So many good things had a place in Sir Felix Pole's speech at the annual meeting of Associated Electrical Industries, Ltd. on April 4th, that it is difficult to decide to which to give first place. The satisfactory financial results and the increase in ordinary dividend have been reported already; the chairman mentioned that the whole of the debenture stock would be redeemed by next July without making any new issue. One most gratifying effect of greater activity in the factories is seen in the employment figures; the present number of employés is 30,000, an increase of 4,000 as compared with a year ago. Men who had to leave during the slump have been re-engaged, and full time working has been restored, as have the salary cuts which were in force for three years. Overseas business has been substantial, power plants and winding equipments for South Africa figuring prominently, but orders from Russia did not materialise to the extent anticipated though a change is hoped for in 1935. In addition to a large volume of business now in hand for overseas customers, the Brazilian railway electrification contract, so long under negotiation, has just been signed. Suburban railway electrification in this country still tarries, but as the speaker remarked it "cannot be postponed indefinitely." Not the least important factor in the situation as reviewed by Sir Felix is the return to a "steady regular placing of orders" for power station plant with the authority of the Central Board. What is taking place in this respect throughout the country is obvious to all who study our weekly record of electricity supply and contract matters.

A Jubilee Gesture

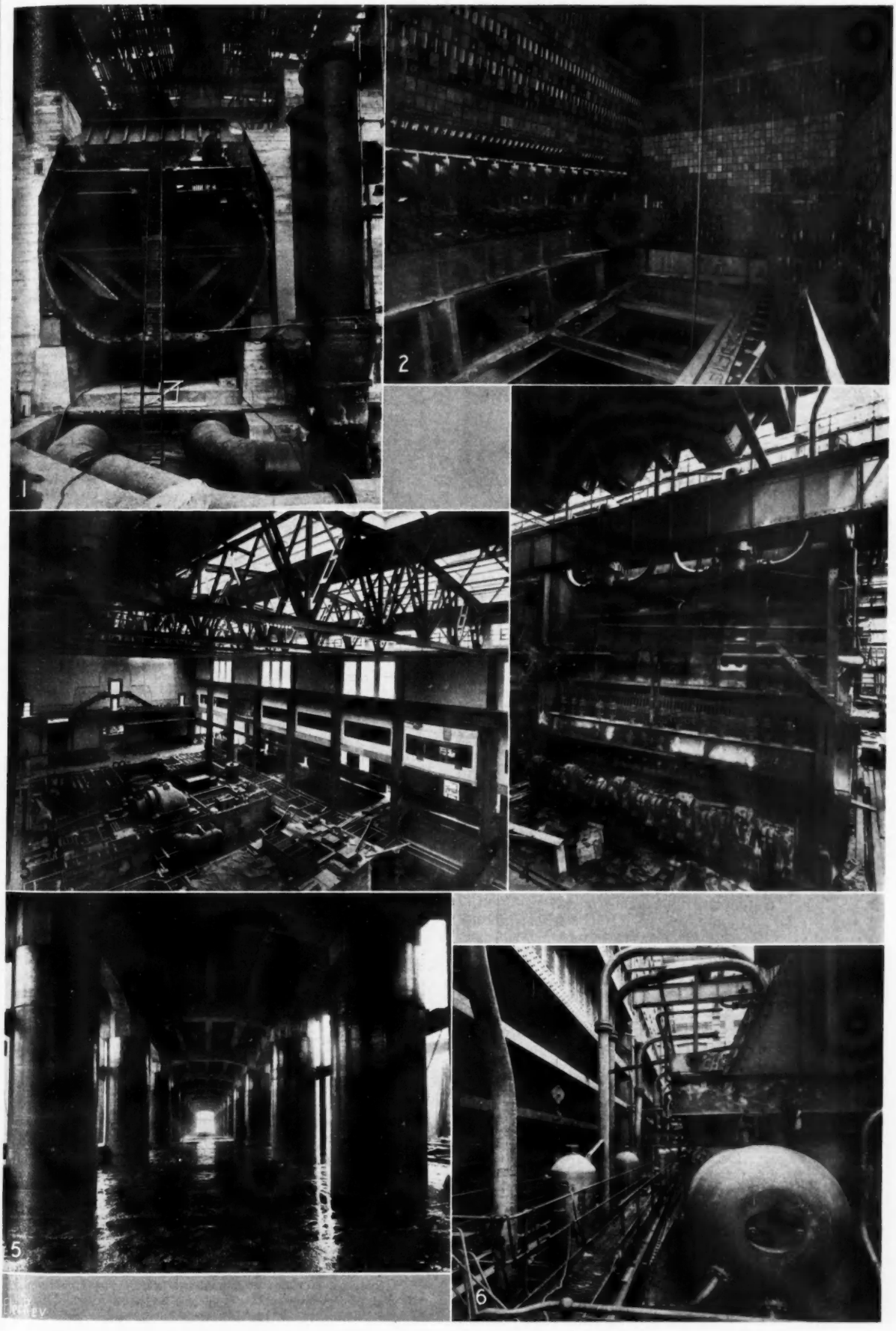
THE spirit of good will which it is desired to foster during the coming Royal Jubilee period has already made its presence felt at Birmingham, where object lessons in real co-operation have recently appeared. Not only has the Electric Supply Department undertaken the floodlighting of many public buildings during the celebrations, but it is co-operating with the British Industries Fair authorities by continuing that floodlighting all through the run of the Fair (May 20th to 31st). A still better exemplification of cordial feeling in the electrical trade is found in the arrangements made for the electrical illumination of the Council House facade. As this does not form a suitable subject for floodlighting proper, the Birmingham E.D.A. Circle, which consists mainly of wiring contractors and a few manufacturers, has offered to be responsible for the cost of the decorative illumination of the Council House frontage by striplite, all the architectural features being outlined in fairy lamps. This arrangement, which will involve an outlay of between £250 and £350 for installation and maintenance, forms an excellent gesture of goodwill toward the Department. We wonder if it is a parable of that larger policy which electricity supply, contractors, and more than a "few manufacturers" are asked to develop at the National Convention at Bournemouth—a policy to co-operatively decorate the front of the whole electrical industry.

Fire-Hoses as Conductors

A NEWSPAPER report that firemen had received shocks when directing a hose upon the electrical installation of a burning building raises the question as to the amount of danger entailed in this way. The classic investigation was that conducted by the Central Electricity Board and the Institution of Fire Engineers on a 132-kV line at Croydon, which was reported in our pages at the time (ELECTRICAL REVIEW, July 14th, 1933). The tests showed that no special precautions need be taken if the length of the jet exceeds 40 ft. for a nozzle diameter of $\frac{5}{8}$ in. or less or 60 ft. for a nozzle diameter of $\frac{3}{4}$ in. At shorter distances, unless rubber gloves are used, a metal nozzle should be earthed. The voltage in this test represented the most extreme condition, so there should be no danger from direct shock from normal distribution voltages with usual jet lengths. Nevertheless, a study of conditions with low voltages and short distances would be of value in ascertaining the possibility of even a slight shock causing a fireman standing on a ladder to lose his balance with possible serious results.

Fulham Power Station

THE new Townmead Road generating station of Fulham Corporation, which is expected to be in commission by the end of this year, is now at a particularly interesting stage of construction, as will be seen from the illustrated article that we publish this week. At the inquiry held by the Electricity Commissioners in December, 1930, objections were lodged against the erection of the station by various public authorities on the ground that sulphur emissions might damage property, but evidence relating to results already achieved with a modified wet dust-extraction plant at the old station showed that such fears were groundless. Since then considerable experience has been gained in sulphur elimination, but its application has hitherto proved expensive. Particulars of the method to be adopted at Fulham are not yet available, but figures of the cost per kW installed will be of quite as much interest as its technical features.



The Fulham Power Station in Course of Construction. **(See next page)**

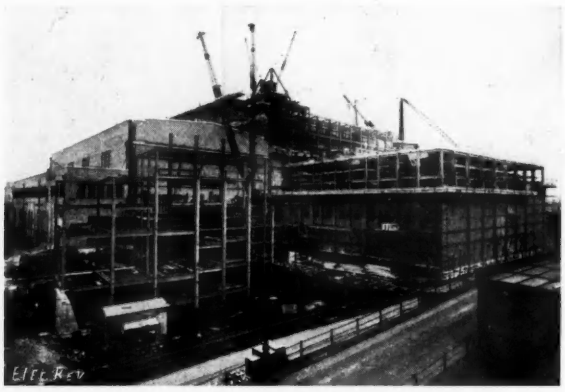
1. One of the condensers in position. 2. Interior of boiler furnace. 3. Starting the erection of a turbo-alternator. 4. Boiler front before installation of stokers. 5. The jetty from the river bed. 6. Top landing of boilers; desuperheaters on left

The Fulham Power Station

Constructional features of the work in progress

THE new power station of Fulham Corporation, which is being erected on newly acquired land adjoining the site of the existing station at Townmead Road, will have an ultimate capacity of 318,000 kW, that of the first section being 120,000 kW in two units, with provision for a third turbo-alternator and an addition of two more boilers to the first six.

The Stirling boilers are rated at 260,000 lb. per hour (m.c.r.)



The Fulham station as it appears at present

for steam conditions at the superheater outlet of 683 lb. per sq. in. and 850 deg. F. They are equipped with Bailey furnaces (of which 108 have been installed to date or are on order for selected stations), a Stirling front screen covered with Bailey blocks to the same height as the side wall, and water-cooled rear walls. These special blocks are of plain cast iron at points where rapid heat transfer is requisite and of cast iron with a refractory filling where maximum temperatures are attained. Their curved backs are bedded on to the tube surface by a heat-conducting paste and clamped to ensure the elimination of air pockets. The walls are protected from deterioration by their being cooled below the fusing point of the ash, the rate of heat absorption being such that a thin layer of solidified slag is formed on the walls. Too slow a heat transfer results in the erosion of the refractory filling until a balance is struck automatically at which the exposed portions are coated with slag once more.

The solid-forged drums are by the English Steel Corporation, the rear drum, which is the larger, is 3¾ in. thick with a diameter of 54 in. and weighs 42 tons. The eighteen-retort Taylor stoker has a width of 31 ft. 5½ in., and about fourteen tons of coal per hour can be fed upwards at different points in the 15-ft. length of the grate.

Automatic Superheat Control

Probably the most novel feature of this station is the use, we believe for the first time in this country, of automatic control of superheat temperature, which is maintained within narrow limits with evaporative duties between 150,000 and 250,000-lb. per hour. This system obviates the difficulty inherent in the use of convection superheaters in that the steam temperature rises with increasing load. The turbine can be protected against an unduly high temperature at the superheater outlet by subsequent desuperheating, but this affords no protection to the superheater itself.

Two " Me Le Sco " superheaters, supplied by the Superheater Co., are installed on each boiler. Steam from a primary superheater passes through a desuperheater, or, alternatively, a by-pass, through a secondary superheater to the range. The relative amounts of steam flowing through the desuperheater and the by-pass (the outlets of which are connected) are controlled by linked Hagan-Venturi butterfly valves, the openings of which are varied in accordance with the movements of pistons in an air cylinder of a receiving regulator. Motion is given to the pistons by air pressure on a diaphragm that is governed by a Hagan thermostat. This regulating equipment is being provided by James Gordon & Co. The two parts of the desuperheater are connected by a Vickers-Anderson joint, which dispenses with most of the bolts normally required.

The Foster gilled-tube non-steaming economiser with a heating surface of 14,700 sq. ft., situated behind each boiler, is designed to raise the feed temperature from 350 to 480 deg. F., the equivalent gas temperatures being 740 and 510 deg. F. The gas temperature will be 240 deg. F. at two Howden-Ljüngstrom preheaters placed over the economiser for supplying air at 400 deg. F. to the furnace at maximum load and 320 deg. F. at 150,000 lb. per hour evaporation.

The Hopkinson boiler and superheater mountings and the Dewrance high- and low-water alarms will be the standard fittings of these firms for similar steam conditions and output. The ash from the grates after passing through crushing rollers will be quenched in hoppers and thence removed by a " Hydrojet " sluice into which water at about 100 lb. per sq. in. is fed at intervals. This equipment is being provided by the Ash Company (London), Ltd., and includes " Hydroseal " vertical-spindle pumps, the wearing parts of which are constructed of an abrasive-resistant alloy; the clean sealing water leaking inwards prevents grit getting between the rotating and stationary parts.

The 300-ft. high reinforced-concrete chimneys have been erected and will later be duplicated, but no work is yet in hand on the induced- and forced-draught fans, or the grit-extraction and gas-washing plant.

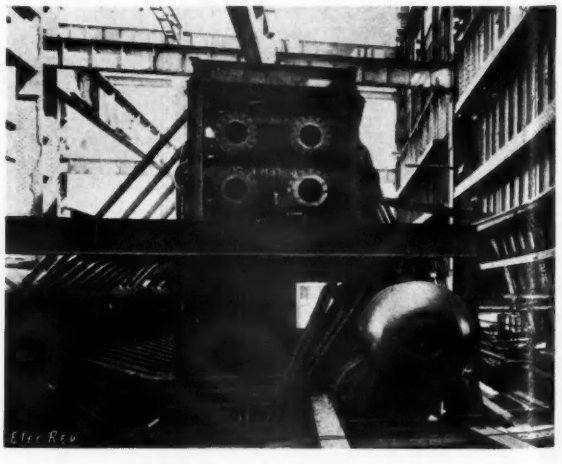
The two 60,000-kW (m.c.r.) Met-Vick turbines are two-cylinder machines running at 1,500 r.p.m., with stop-valve steam conditions of 600 lb. per sq. in. and 825 deg. F. The h.p. cylinder comprises a velocity stage and twenty-one impulse stages, and the l.p. cylinder thirteen impulse stages, terminating in a duplex multi-exhaust. Three parallel admission valves control loads up to 60 per cent., 80 per cent., and full m.c.r. The h.p. cylinder is bled for the Met-Vick feed-water heater, de-aerator and evaporator at one stage, and the l.p. cylinder at three stages.

The Vickers-Armstrong all-welded regenerative condensers, with 54,000 sq. ft. of cooling surface, are said to be the largest of single-shell construction yet made in Britain. They were delivered in two sections, which were welded together on site. Two circulating-water pumps are provided for each condenser to permit independent cleaning of the halves. Each has a capacity of 22,000 g.p.m. against a head of 23 ft. and is driven by a Met-Vick 485-r.p.m. s.r. motor, the speed of which can be reduced to 290 r.p.m. by rotor resistances.

The Generating Plant

The 11-kV alternators are rated at 75,000 kVA. Cooling is on the closed system, movement being imparted to the air by fans mounted on the rotor reinforced by two motor-driven fans at the heavier loads. The 10,000-kW house set consists of a Brush-Ljüngstrom double-rotation radial-flow reaction turbine, bled at two points, driving two 5,000-kW 6.6-kV alternators and exhausting into a Brush-Delas condenser.

The switch-house is being built in three sections to be connected to the turbine house *via* the control room. Each section is designed to accommodate the 1,500,000-kVA 66-kV circuit-breakers required for the control of one of the alternators (connected direct to the terminals of its step-up transformer), four feeders and a bus-bar reactor. A system



Superheaters in course of erection

of tie and transfer bus-bars will give considerable flexibility in switching connections.

Metro-Vick cross-jet explosion-pot contacts will be applied to the circuit-breakers, which are to be of the metal-clad vertical lift-up type with oil-immersed isolating plugs.

Our thanks are due to Mr. A. J. Fuller, joint consultant with Messrs. Preece, Cardew & Rider, for the design and construction of the station, and to Mr. H. Clarke, the resident engineer, for facilities afforded us in connection with the preparation of this article and for permission to reproduce the photographs taken by Messrs. Burfords on their behalf.

Suburban Electrification. By Sir Philip Dawson, M.P.

The case of Liverpool Street

EVER since the grouping of railways came into effect the electrification of suburban lines serving the area north and east of Liverpool Street Station has been put off for one reason or another, although repeated statements have been made in the House of Commons that the matter was receiving very serious consideration.

The whole problem was completely investigated and reported upon during the years 1919 and 1920, and the then general manager of the Great Eastern Railway Co., Sir Henry Thornton, had definitely decided to electrify all the lines between Liverpool Street Station, Hertford, Bishop's Stortford, Ongar, Chelmsford and Southend. The scheme envisaged by Sir Henry Thornton went a great deal farther than mere suburban electrification and included the electrical handling of all traffic in and out of Liverpool Street so as to enable the whole area occupied by the station and its approaches to be covered in; on the site thus created, buildings were to be erected as has been so successfully done over the approach to the Great Central Station in New York City.

Sir Philip Dawson, M.P., M.Inst.C.E., M.I.E.E.

By this means a site of some six acres would have been made available in the heart of London for building purposes, the value of which would have gone a long way to cover the total cost of electrification. It had been estimated that over a million pounds would be required to install new signalling and additional traffic facilities, such as flying junctions and widenings at Stratford and Bethnal Green.

Sir Henry further envisaged the possibility of building a double-deck station at Liverpool Street with a tube to take full-sized rolling stock which should terminate at Oxford Circus. As far as Piccadilly the line would have been the same as that embodied in the proposals for the Piccadilly, City & North East London Railway, which had been deposited in Parliament in 1902. These proposals had received the approval of Lord Windsor's Committee in the House of Lords, but had been thrown out in the Commons because the scheme had been put forward as one which would facilitate the communication between east and west, and the Commons did not consider that it went far enough.

Sir Henry's proposal was not merely for inter-communication but was intended to collect passengers from the east and distribute them in the west and thus relieve the congestion on the tubes, the Underground Railway and the buses, at the same time relieving the overcrowding at Liverpool Street and avoiding the need for passengers changing there in order to go farther west. In view of the special object of this line it was proposed to limit the stations to the smallest number, and investigations showed that on the face of it the scheme was practicable. Furthermore, the Great Northern & City had powers granted in 1913 to extend to Liverpool Street and could have been worked into the proposals.

The thorough study of the whole problem made at the time showed that, even without the proposals mentioned above, electrification would increase the capacity of Liverpool Street Station by fifty per cent.

Growth of Population

Since Sir Henry Thornton's time the London County Council has erected the large Becontree Estate and much building has taken place all over the area; the traffic has outgrown the potentialities of the terminus and has completely exhausted the possibilities of satisfactorily dealing with it by means of steam. The overcrowding of the terminus and trains at rush hours has resulted in serious restrictions on goods trains operated over the most important routes within the central area, and has brought about a serious disorganisation of the reception and distribution of merchandise. On the Colchester line between Chadwell Heath and Shenfield there is a grade of one in a hundred from the London side of Brentwood 3¼ miles long, which greatly hampers speed; here electrification would be of the greatest value in accelerating the services.

After the grouping of the railways the London & North Eastern Railway Co. was made responsible for the operation of the old Great Eastern Railway. The stock reply to the many questions asked in the House of Commons from 1921 onwards was that schemes were in preparation and that the whole matter was receiving consideration; at one time it was even stated that the electrification, not only from Liverpool Street, but also from King's Cross Station, would shortly materialise.

The legislation which established the London Passenger Transport Board created a new situation and until this Board began to function, the answers given in Parliament were that the railway company had prepared schemes for submission to the Board and until the Board had approved them nothing could be done; later the railway company took up the position that owing to the special local conditions electrification was inadmissible. It estimated that the net revenue would be insufficient to justify the capital expenditure and considered that its first duty was to its shareholders and not to its passengers. This is a totally different attitude from that adopted by the Southern Railway, which found no difficulty in raising the necessary money to electrify not only its suburban lines but also its main lines to Brighton, Worthing and Hastings.

The speeches delivered by the chairman of the Southern Railway at its annual meetings for the last seven years have indicated that expectations have been more than justified and that further plans are under consideration for extending the electric services. All this work was carried out by the Southern Railway without any application to the London Passenger Transport Board for financial assistance.

Now at last the L. & N.E.R. Co. finds itself in the happy position of putting the blame of not electrifying on to London Transport. It was perfectly clear to all those who are familiar with the present situation that having regard to its very heavy responsibilities and liabilities the Board could not for the moment undertake the task of raising several million pounds, although doubtless it would not put any hindrance in the way of the L. & N.E.R. doing so and thereby following the example of the Southern Railway.

Mr. Whitelaw, the chairman of the L. & N.E.R., recently said that he would not burden the dividend fund of his company by embarking on schemes however loudly they might be demanded, but if the demand became so insistent that public funds were provided, he would not stand in the way, as he thought that out of such schemes the company might derive advantages.

A Successful Precedent

For twenty-five years I advised the Brighton Railway and was responsible for its electrification schemes, every one of which proved an economic success, and in every case the results exceeded those which I had anticipated. I prepared and submitted a complete scheme for the electrification to Brighton, Eastbourne and Hastings in 1921 and the satisfaction expressed by the Southern Railway at the results achieved in this area more than confirm my anticipations. This is only referred to because, in collaboration with Mr. George Gibbs, the well-known American engineer, whose experience in connection with every kind of electrification throughout the world is unique, I was retained by the Great Eastern Railway Co. in 1919 to investigate the possibilities of the electrification of its lines in and around London and I spent some four years on this work.

There is no doubt in my mind that provided electrification is carried out on the lines which I laid down good results would be achieved, all the more so as the capital expenditure envisaged, having regard to the high costs then existing, would be materially reduced if the work were done now. Both Mr. Gibbs and I were of the opinion that electrification should be carried out and the views which we expressed were accepted both by Sir Henry Thornton, the general manager, and Lord Claud Hamilton, the chairman of the company. The creation of the Central Electricity Board has, moreover, greatly simplified the problem.

Since the investigation was carried out I have frequently pointed out both in and outside Parliament that if the railway company merely objected to carrying out the necessary improvements because it did not wish to raise fresh capital, then, in the interests of unemployment and of the country, the Government might well step in and guarantee the interest on the capital required for electrification with very little risk to itself.

Electrification is a form of enterprise which provides work for every class of industry and particularly to those industries which at present most need it; incidentally it would materially increase the traffic of the railways during the construction period. Furthermore, the absence of smoke and steam in the congested areas traversed would be a great public benefit.

Improving Domestic Appliances. By Ann Penrhos

The woman's point of view

IT would appear that, through lack of foresight on the part of manufacturers of electric cookers, the gas authorities are securing more than their share of the business which is available from the new housing estates and flats. Most electric cookers incline towards the appearance of the gas oven, and need redesigning. If space permits, the American type of cooker, that is, the table or buffet style, with the oven and hot-plates side by side, is ideal, as all stooping is avoided. Electrical units, which may be purchased piece by piece, are very popular in the States.

Many Canadians favour a combined kitchen cabinet and electric cooker equipped with a slide directly under the range frame which can be used as a mixing board. Drawers situated at the right of the cabinet afford easy access to cooking ingredients, the bottom one being tin-lined. When the drawer is closed it automatically slides the tin cover over the bread box so that no heat from the oven enters the cabinet.

While the gas oven is limited in design, owing to the necessity for providing an outlet for the fumes, the electric one is not, and certain improvements would tend to reduce the number of repairs. Manufacturers should consult the consumers' salesmen to ascertain the exact requirements of the householders. It would seem advisable that all fuses should be mounted on the front of the cooker, either over or under the switches, and a spare fuse carrier provided. Probably a small yet efficient circuit-breaker could be obtained quite cheaply and inserted in place of the fuses.

The Boiling-plate Question

After making careful inquiries in different parts of the country, I find that there is a great demand for the enclosed-type boiling-plate, although its speed does not reach that claimed for some open types. No appreciable distortion of the solid plate will occur if iron of suitable composition is used and it is properly annealed. I think we may safely assume that the enclosed plate has come to stay, and can only hope that it will be still further improved. The retained heat, after switching off, is a valuable economic factor, for food can be kept simmering for over thirty minutes and hot for an hour, or even longer, if the correct utensils are employed.

Different types and makes of boiling-plates require individual utensils if the best results are to be obtained. Heavy-gauge flat-bottomed pans must be used on the solid plates, but on the open type ordinary enamelware appears to give a better performance. A test made recently revealed the fact that an 8-in. diameter solid boiling-plate with a loading of 1,600 W and a pan of the same diameter with a ¼-in. thick, machined bottom boiled three pints of water in ten minutes.

Standardisation of oven-heating is absolutely necessary as the methods of cooking by the three types of heating—side, side and bottom, top and bottom—vary considerably. Excellent results in cooking, whether it be bread, cakes, pastry or joints, may be obtained with any of the three methods, but it requires thought and great care to accustom oneself to the change.

The switches on all cookers should be white, with a jet-black background, so that it is possible to see at a glance the position of each when cooking. Thermostatic control would certainly be an additional refinement, but would the cost of fitting it to a cooker be so exorbitant that the hire charges would have to be increased out of all relation to any benefit which might accrue? My own opinion is that three-heat switches provide adequate control and so make a thermostat unnecessary.

A move in the right direction towards popularising electrical cooking would appear to be to include a set of three different sizes of correct saucepans (in addition to the electric kettle) with each cooker, and let it be part of the hire charge. This is the only satisfactory way of overcoming the "hot-plate" trouble, as most of the dissatisfaction expressed is due to the use of unsuitable utensils.

Only Three Sizes Needed

Three sizes of cookers should be sufficient to cater for the needs of all consumers. A flat rate appears to be the only practicable tariff if the domestic load is to be properly developed and the idea that it is far too expensive to cook by electricity banished from the minds of the public.

When selling a cooker to a woman it is absolutely vital to create a "buying" atmosphere. Technical details are out of place; she must be made to feel a sense of loss by not possessing such a clean, compact appliance. Also, it must be remembered that it is quite easy to turn out excellent cakes, &c., with the cheaper ingredients. These are often equally nutritious and have to be used on the grounds of economy by many housewives. Many of the less expensive cuts of meat can be cooked just as successfully in an electric oven as the choicer pieces.

It has been said that this machine age is making woman more and more afraid of originality, and that she shows it only too well in her cooking. Personally, I think that the supply authorities have been very slow in not pushing the merits of electric cooking further. If any appetising recipes are given in the daily papers or women's journals an up-to-date cooker, but of the *gas* type, is always shown much to the fore. "Mr. Therm" is also much in evidence.

I have sought in vain for an electric toaster with a removable element, contact being made by a sliding spring contact in the base, so as to facilitate cleaning. At present the only means of removing the crumbs appears to be by the use of a small brush. A small switch should be fitted into the frame.

Coffee percolators are still too expensive for the majority of consumers to take advantage of, yet they may now be considered to be reasonably efficient, and the saving in the quantity of coffee (due to no grounds entering the liquid) needed at one operation is an offset towards the initial cost.

Electric kettles, water-heaters and refrigerators give very satisfactory performances, yet one could wish that the last mentioned were not quite so expensive. The charge for water-heating is still far too great; many more consumers would take advantage of this means of supplying the household with really hot water if a special rate were available.

A clothes-airing apparatus is most necessary for consumers residing in small modern houses or flats. Is it possible for hot air to be emitted from a machine on the same lines as a hair-dryer, but designed with a 2- or 3-kW heating unit? Electric wash-boilers do not compare favourably in price with the gas boiler, which may be purchased for as little as 14s., the larger size being 21s.

There is a definite demand for electric fires of low ratings, and one of 500 W or 750 W is sufficient for the modern kitchenette. For the small dining-room one loaded at 1½ kW would fulfil a long-felt want. I wonder why manufacturers send out fires with such a short length of flex attached? When airing a room it is usual to place the fire in the centre, yet this is only possible by affixing a new length of cord.

Care of Flexible Cords

Until recently most flexibles attached to electric irons broke near the connector after a few months' use; now, however, there are several unkinkable cords on the market fitted to reliable adaptors in such a manner that there is no possibility of this occurring. There is also a tendency on the part of some manufacturers to fit three yards of flexible instead of two, which was the usual custom until recently. The switch-connector saves much time, trouble and energy, and the cord suspender prevents the trailing of the cord during ironing operations. The electric iron may be safely said to be much superior in all ways to its near neighbour, the gas one, which is most unsightly and cumbersome.

In conclusion, may I mention that to get the best possible results with all electrical appliances it is necessary to give them an occasional "spring clean." Flexibles sometimes fray, and it is quite an easy matter to replace these; connectors occasionally chip; and all badly fitting plugs should be discarded. Plugs of any standard British make will fit B.S.I. sockets of any manufacture. Motor-driven appliances may need oiling; in this matter the instructions given by the makers should be carefully followed, and the machine should not be over-oiled.

Research at Glasgow

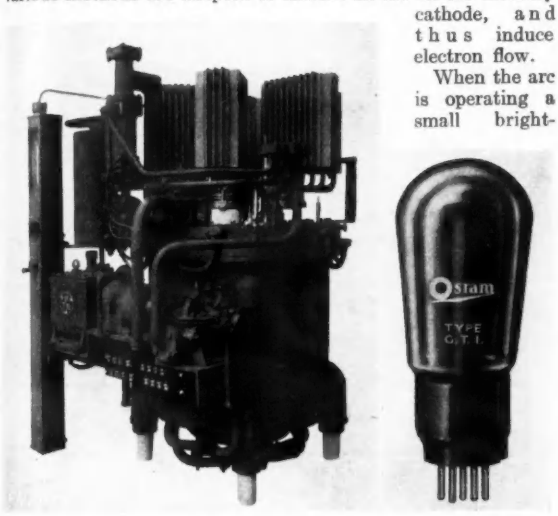
A recent issue of the *Journal* of the Royal Technical College, Glasgow, contains a record of some of the research work carried out in the College by the staff and senior students. Messrs. J. L. Hamilton and D. J. W. Boag describe two stroboscopes devised for accurately determining the speed fluctuations in rotating machinery, namely, accurate visual and photographic recording instruments. Their application to the measurement of the speed variations that occur during the final stage of the starting period of a synchronous induction motor is fully explained. Dr.-Ing. K. Szegho deals with modifications of the cold-cathode Braun tube and investigations into the use of metal discharge tubes to prevent continuous working with larger currents and at higher voltages than can be used with the usual sealed-glass type. A new type of self-renewing cathode is described, and the author also shows how fine trace and effective trapping may be obtained when large (2 cm.) anode apertures are employed. The rectifier action of the tube is investigated and two methods are mentioned of using a single cathode to produce two cathode rays suitable for independent deflection, thus permitting the simultaneous recording of two related quantities.

Grid-controlled Mercury Valves. By W. Woodiwiss, A.M.I.E.E.

How they operate

THE grid-controlled mercury valve is manufactured in a form resembling the radio glass-bulb thermionic valve, in the cinema quartz-bulb type, and also in the steel-tank type used on heavy power work. Its ratings vary from 150 W to 1,500 kW, and its applications are almost as varied as its output.

The principles governing both large and small controlled rectifiers are fundamentally the same. In practice the 150- to 600-W rectifier has a heated, oxide coated, electron emitting filament to start the current flow; in the heavy duty types various methods are adopted to initiate an arc on the mercury cathode, and thus induce electron flow.



Two kinds of controlled mercury valves: That on the left is a B.T.H. steel tank unit, and the other is a G.E.C. glass bulb type

When the arc is operating a small bright-white spot is seen on the mercury. This incandescent area is at a temperature of some 2,000 deg. C., and a large number of negative electrons are emitted from the mercury at this spot. They are ejected with a certain velocity into the space within the enclosing vessel, which is charged with neutral mercury molecules. These negative electrons travel with increasing speed towards the positive anode on account of its power of attraction, and the phenomenon of ionisation by collision takes place.

When an electron strikes an ordinary neutral mercury molecule with sufficient force it liberates an electron and, in leaving the molecule deficient, creates a mercury ion; that is, the molecule that was formerly neutral has now a resultant positive charge. The electrons liberated by ionisation go to increase the stream of cathode-generated electrons travelling towards the anode. The relatively massive positive ions are attracted towards the small negative-cathode spot and by their vigorous bombardment maintain it at a high temperature.

Although the negative electrons bombard the anode their distribution is not concentrated and their mass, relative to the ion, is small. Consequently the temperature rise of the anode is only some 600 deg. C., and an average of 5 W per A may be taken as the anode dissipation.

With the small type of controlled rectifier the same ionisation phenomenon results from the electrons emitted from the filament into the mercury-gas space, and it is this process of ionisation that gives the mercury-vapour valve features totally different from those of the thermionic radio valve. The latter is filled with an inert gas and the valve current can be considered as being composed entirely of negative electrons, a resultant negative space charge effect being created that tends to prevent the emission of electrons from the filament. Some 200 V is required to pass a current of 30 mA, whereas in the mercury-arc valve the presence of positive ions in the current stream tends to neutralise the space charge effect and only 25 V is required across the valve to pass a current of hundreds of amperes. The pressure drop is, in fact, essentially independent of the current and 0.1 V per cm. of arc may be taken as an average. It is this same phenomenon of ionisation that explains the different results obtained with the radio valve and the mercury arc valve when grid control is applied.

The anode current in the radio valve may be increased, decreased, or reduced to zero by suitably varying the negative potential applied to the grid. This complete control is possible because the current is composed principally of negative electrons, which are always under the influence of the negative grid potential. In the mercury arc valve operating under normal conditions the anode current is not under the influence of the control grid, because of the positive ions present in the current stream. If, when ionised current is flowing, the grid is given a negative potential it will repel the adjacent electrons and attract the positive ions; these collect around it to form a screening sheath, so neutralising its electric field and its control power.

When the cathode is emitting electrons and only a small steady potential of 5 to 15 V is applied across the mercury arc valve so as to make the anode positive, relative to the cathode, the cathode-generated electrons travel to the anode and constitute a small current of some milliamperes. Since the current stream is purely electronic the valve resembles the high impedance radio valve. An increase in anode pressure will give a proportionate increase in anode current until the critical pressure of, say, 25 V is applied. This voltage accelerates the electrons to such an extent that ionisation due to collision results and the current rises immediately from milliamperes to a comparatively large value.

The Effect of Grid Bias

Since, prior to ionisation, a purely electronic current is flowing the control grid can exert its influence to neutralise the anode electron-accelerating field. If for a given anode voltage the control grid is given a negative potential, its electric field will oppose that of the anode and the acceleration of the electrons will not be so great as it would be if the grid were absent. As a direct result of its influence on the acceleration of the electrons, variations of the control grid potential result in variations of the anode voltage necessary to produce ionisation. For example, whereas the "Osram" GT.1 gas-filled valve with a negative grid bias of 7.5 V needs an anode pressure of 200 V to produce ionisation, with a grid bias of 15 V the necessary anode ionisation voltage is 400 V; that is, it is increased in direct proportion to the increase in grid bias.

Supposing that for a given anode voltage the grid bias were gradually diminished from a high negative value to a value at which ionisation takes place, then this value would be called the critical negative grid pressure for that particular anode voltage. A curve plotted to show anode voltage against

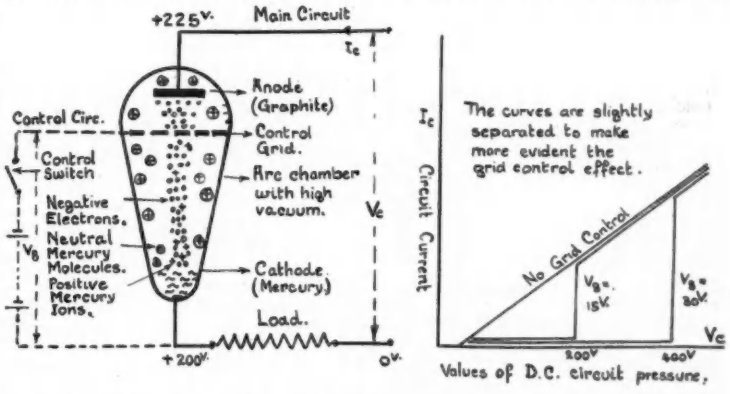


Fig. 1: Construction of the controlled mercury valve and its characteristic curve

critical negative grid voltage is linear, and the ratio of anode pressure to critical negative grid pressure is a constant termed the grid control ratio.

The characteristics of the grid-controlled mercury valve may now be summarised. Prior to ionisation grid control is possible. An increase in grid bias negative potential causes an increase in the anode voltage necessary to produce ionisation and operating currents. If the negative grid potential is reduced or the anode potential increased so that ionisation results, the current will rise immediately to the value it would have if no bias control grid were present, and the grid cannot then control the current. This feature is analogous to the trigger action of a rifle, and circuits utilising it have been called trigger circuits. Similarly, one manufacturer named the valve a "thyratron" (from the Greek word for door) because the valve "locked" a circuit to operating currents until the "key" (or critical voltage) was applied.

The many ingenious applications of the valve are based on

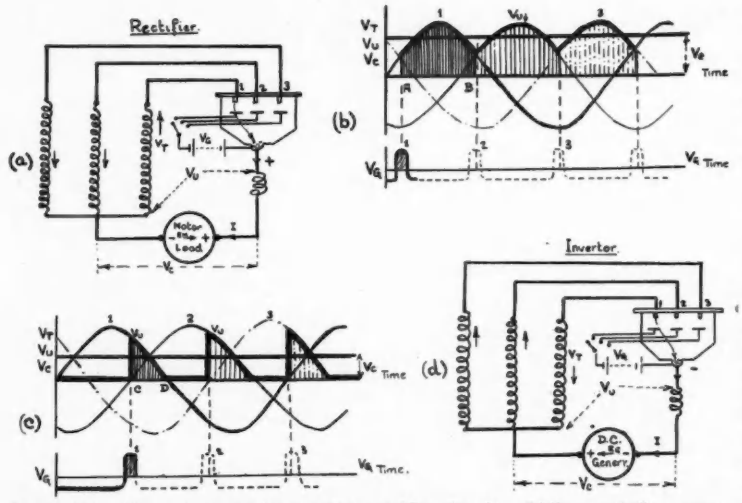


Fig. 2: (a) A three-phase grid-controlled rectifier circuit. (b) Commutating curve assisted by positive impulse. (c) Curve with ignition retarded. (d) A three-phase invertor circuit

this trigger feature, two of which in the case of the heavy duty rectifier, are the compounding of its characteristic curve and the operation of the mercury arc rectifier as an invertor to give an a.c. output from a d.c. input.

When an alternating voltage is applied to the valve anode current may flow only during the half cycle that makes the anode positive, relative to the cathode. By means of the grid control may be exercised to determine the particular instant in each cycle at which anode current-flow commences. If a large current is required the flow must be commenced as soon as the anode pressure is 25 V, and to ensure this a positive impulse is given to the grid at this instant. If a small current is required the ionisation (or "ignition") point is retarded by maintaining the grid at a negative potential until the anode has passed through its maximum value. When the required point is reached the grid is given a positive impulse to assist ionisation. Evidently, the more the "ignition" is retarded the smaller will be the d.c. output.

Applications Illustrated

The application of grid control to the simple 3-phase rectifier shown in fig. 2 (*a*) is illustrated by the curves in fig. 2 (*b*) and 2 (*c*). At A in 2 (*b*) anode 3 has a diminishing positive voltage and anode 1 a positive increasing voltage. Consequently the arc commutates from anode 3 to 1, assisted by the positive impulse given to grid 1, and operates on anode 1 up to point B.

Fig. 2 (*c*) shows the "ignition" retarded to 120 deg. The negative potential on grid 1 prevents "ignition" until point C is reached, when the positive grid impulse initiates current flow and the anode current assumes its normal "instantaneous" values. But, due to the large zero period in each cycle, the average value is greatly diminished and in this particular example there will be no true commutation since the arc will be extinguished at D.

This property of grid control in varying the d.c. output current and voltage is utilised to give the rectifier a compound characteristic to compensate for voltage drop due to increased load. Thus, if at no load the "ignition" angle is retarded to 50 deg. when, as load is increased the ignition angle is reduced to, say, 30 deg., the necessary compensation will be given.

Evidently, if the "ignition" angle is retarded to 180 deg. there can be no d.c. output from the positive half waves. If the "ignition" angle is increased to, say, 210 deg. there may be an a.c. output. Suppose the d.c. generator opposes the transformer-generated negative voltage and is some value intermediate between zero and the maximum negative value. At point E the generator voltage will be numerically greater than the transformer opposing voltage and the rectifier anode positive relative to the cathode and current flows. Since this current flows through the transformer in opposition to the generated voltage, the transformer will now be absorbing power. This current is in the same sense as the d.c. generated voltage, hence it will

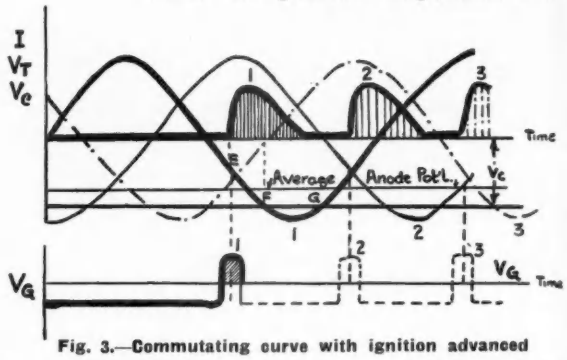


Fig. 3.—Commutating curve with ignition advanced

deliver power at an alternating voltage and the combination will be acting as an invertor.

At point F the anode becomes negative, relative to the cathode, and the anode current starts to diminish, but due to the circuit inductance its flow may be prolonged until the critical point G is reached. At this point the anode becomes positive and, if the anode current were allowed to continue on anode 1, a severe short circuit would result, since during the positive half cycle the transformer and generator voltages are in the same sense. The negative potential on grid 1 prevents this.

Obviously no a.c. can pass through the rectifier and the transformer excitation has to be provided by auxiliary apparatus. The frequency of this excitation current determines the frequency on the a.c. output side of the transformer.

Radio Interference Suppressors

IN August last year the Radio Component Manufacturers' Federation issued a standardisation report which dealt, among other things, with standardised ratings for, and tests to be applied to, interference suppressors, together with safety precautions to be observed in installation.

The Federation now states that it is alarmed to note that such devices now being placed on the market do not in all cases appear to have been tested in such a manner as will ensure safety to their users. It explains that its standards were arrived at in conjunction with representatives of the I.E.E., R.M.A., B.B.C., G.P.O., electric power supply authorities B.E.A.M.A. and E.R.A. which are working together to produce a new British Standard Specification on the subject.

The R.C.M.F. standards agree substantially with the clauses at present under consideration, and it is inconceivable that there will be any substantial alterations in the safety regulations, since they are the minimum necessary to make suppression components as safe as the electrical appliances and installations to which they are to be fitted, in order to comply with I.E.E. Wiring Regulations, Board of Trade regulations, insurance company requirements, &c.

Thus it is totally inadequate to use the normal type of radio condensers tested at 500 or 750 V d.c. for an interference suppressor which is to be used in conjunction with electrical apparatus tested at 1,500 V a.c. from terminals to earth. The condensers must obviously be capable of withstanding the same 1,500 V a.c. test, or its equivalent 2,250 V d.c. In practice the Federation specification calls for the latter test for a period of one minute, since the a.c. test would be harmful to the life of a condenser. This means that the condensers must necessarily be about three times the size and cost of the normal types used in constructing a radio set.

While the cheaper condensers are quite permissible inside a radio set where failure merely means that the set stops working, outside failure might be very serious, since it would frequently result in the frame of an unearthed appliance becoming alive. Another safety requirement is that an unearthed portable appliance must not have a greater condenser than 0.01 mF. connected from either terminal to the frame, due to risk of shock from an unearthed frame.

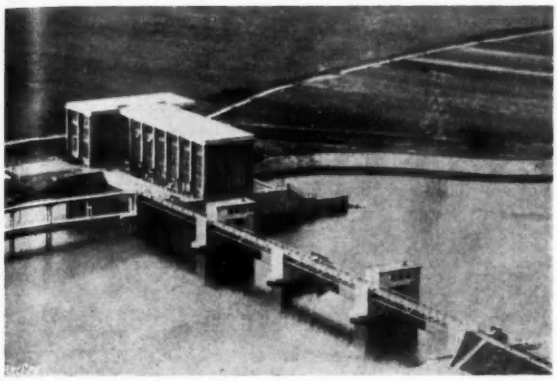
Another important subject is the use of separate fuses, and in this connection the Federation is altering its regulations to read as follows:—"Interference suppressors shall be protected by separate fusible cut-outs against the breakdown or overload of any component, except when the suppressor is built into and forms an integral part of an appliance, or when the suppressor is so designed that it can only be used in sub-circuits which are already protected by sub-circuit fuses of sufficiently low rating." This means that any suppressor which might conceivably be connected to a listener's main entry must have separate fuses, in order to obviate any possibility of blowing the main circuit fuses.

Finally there is some likelihood of electricity supply authorities stipulating that all condensers shall be readily detachable from an electrical installation for the purpose of conducting an insulation test on the installation with ordinary equipment. False readings would usually be given if condensers were in circuit. Thus any condensers which are not disconnected by the removal of a plug should preferably be so arranged that they can be disconnected by some other simple means.

Water Power from a Difficult Source. By S. H. Kahn

CONSIDERABLE seasonal fluctuation in the flow of the River Moselle, France, made the task of constructing hydro-electric plant near Metz a difficult one, but the work has now been completed successfully. The site is at the mouth of the Argency canal, where a dam was built some years ago for the purpose of regulating the flow of water in the canal.

On account of the small head of water the chambers above and below the turbines have syphons. The walls are of reinforced concrete which was poured into carefully planed and internally painted moulds to produce a smooth surface. On account of the proximity of the canal gates and the current

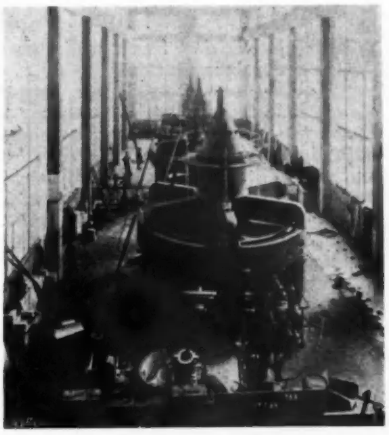


The new hydro-electric power station near Metz

of the river it was feared that whirlpools might form which would have interfered with the proper operation of the plant. To avoid these a series of fixed blades was built into the intake channel to direct the water.

The Moselle has a seasonal variation from 4,180 to over 233,000 gal. per sec. Of this only 880 gal. flows into the canal, so that the rest is left for power purposes. As the river rises the fall decreases, running between 12 ft. 6 in. and 6 ft. 6 in.

In order to make the best use of the power in spite of the variations vertical Kaplan turbines, with variable blades, are used. They are calculated to develop 1,400 h.p. with a flow of 29,740 gal. per second and a fall of about 11 ft. These conditions are fulfilled during about eight months of the year. It is only during the summer months, when the river is low, that the efficiency of the turbines drops to about 75 per cent. The angle of the blades and the water distribution are automatically regulated in accordance with the seasonal flow of water.



A group of turbo-alternators

To each turbine is connected a 1,360-kVA, 5,500 V alternator. The stators of these alternators are welded into one piece. On account of their large size the inductor rotors were assembled during the mounting of the alternators. Each alternator is directly connected to a step-up transformer lodged in a cell at the base of the plant. In this way any danger of fire in the plant is avoided.

In the sub-station the switches are all of the compressed air type. All the operations are indicated on a luminous signal board above the control desk. The water supply can be cut off from any one of the turbines by means of automatic gates 33 ft. 6in. wide and 17 ft. 8 in. high, which can be completely closed in 17 sec. The controls are arranged to close the gates should the water reach a predetermined level or cease to flow, or should there be a breakdown in a machine.

An Electric Crematorium

A FEW years ago the first electrically heated crematorium was built in Switzerland. As a result of further studies of the problems involved Messrs. Topf & Söhne have now developed an entirely electrically operated and heated furnace of a more practical type, which they have installed at Erfurt, Prussia.

The body of the furnace is of fire brick, filled in with earth heat insulation, the top being arched. On each side of the interior of the furnace are six heating coils of chrome nickel, fitted into slots. These heat the oven proper, but to insure a rapid consumption of the coffin the cast-iron support plate is heated by two more coils. There is a double door, the inner sliding up and down in a track and the outer one hinged. At the back of the furnace also is a small door which permits the attendants to watch the incineration. As this proceeds the ash breaks away from the body and falls through the grate at each side of the support plate to a sloping plate below, which is further heated by six coils. When the burning on this plate is terminated the ashes are pulled on to a small grate. Here they are completely consumed into fine white ash which falls through the grate into the chamber below, whence they are transferred to the urn.

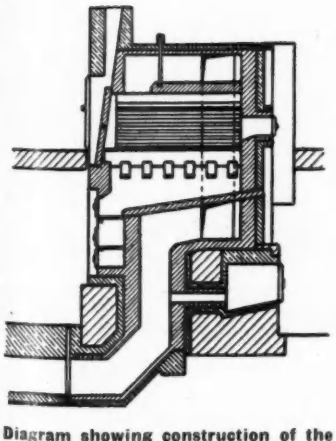


Diagram showing construction of the crematorium (vertical section)

At the bottom of the furnace a fan blows air through a 3-in. pipe which runs through the lower part of the furnace and the heating chamber, so that it is pre-heated before it reaches the furnace proper through holes in the sides of the base. The furnace is operated by button controls at the back or in a cabinet at the side. The total connected load amounts to 100 kW, and in order to take advantage of the cheaper night tariff a time clock is arranged to switch on the furnace so that cremation need not take place as soon as the body has been introduced into the oven. The temperature of the furnace is regulated by a thermostat.

The coffin is put into the furnace by two moving bars projecting from the floor and operated by a push-button. Relays control the raising of the coffin and its consignment into the furnace.

Electrical connections at the rear of the furnace

The efficiency of the crematorium proved to be even greater than was anticipated, due partly to the furnace rarely being allowed to cool entirely so that it has been found unnecessary to start each time from cold.

During a month in which there were sixty-three cremations the average consumption per cremation amounted to 46.2 kWh. The temperature at the beginning of the operation is controlled to about 425 deg. F., but towards the end this is raised to as much as 1,280 deg. F.

Thermal Properties of Insulation

Important developments in the direction of increased heat conductivity

WHILE electrical insulation is the essential function of the insulating material applied to electrical conductors, ability to withstand high temperatures without loss of mechanical and electrical qualities permits operation at higher ratings and in more difficult service. Applications in which high temperatures are inevitable are, however, a class by themselves; the use of insulation of higher thermal conductivity would often avert the development of high temperatures.

Besides avoiding troubles which may arise from the overheating of organic insulating materials, any increase in the thermal conductivity of the insulation makes possible either a saving in copper or an increase in loading for given expenditure of copper while working within the same limits of temperature rise. Important developments in this direction are reported by A. Meissner in *Elektrotechnische Zeitschrift*, data concerning the thermal conductivity of various materials being supplemented by particulars of apparatus embodying high-conductivity insulation.

The thermal conductivity of crystals is from 100 to 1,000 times that of the electrical insulating materials hitherto employed, and approaches that of metals. For example, the thermal conductivity of diamond is nearly half that of copper, while the conductivity of quartz is about one-quarter that of iron and about 100 times that of ebonite and sealing compound. The importance of crystalline structure in this connection is demonstrated by the difference between crystalline and fused quartz; the loosening of the structure and the formation of cavities in the amorphous material results in the specific gravity being reduced to 2.2, compared with 2.65 for crystalline quartz, and the thermal conductivity is reduced from 0.03 to 0.003 calorie-cm.-deg. C. units.

Crystalline Impregnation

Electrical insulating materials at present used industrially cannot be given a crystalline structure, but they can be impregnated or loaded with crystalline materials sufficiently to increase considerably their thermal conductivity without unduly affecting their other properties. According to circumstances, the thermal conductivity can thus be raised to from five to eight times the normal value for the insulation concerned. The heat conduction is mainly by the crystalline filling, the amorphous electrical insulation filling the interstices and eliminating air films round the heat-conducting particles. The author recommends the use of high-quality quartz sand in its natural form with rounded edges and mixed sizes. Crushed quartz, as used for porcelain manufacture, is not suitable for the present purpose, the sharp edges hindering heat transmission and reducing the space factor.

For convenience in calculation, the thermal characteristics of electrical insulation should be expressed in terms of watts or kilowatts instead of heat flow per second. If the thermal conductivity of a substance be k grm.-calories per sq. cm. per sec. through a slab 1cm. thick with a temperature gradient of 1 deg. C. per cm., it is 4.18 k watts per sq. cm. (since 1 grm.-calorie per sec.=4.19 W). The thermal resistivity $K=1/(4.18\ k)$=temperature difference in deg. C. required to transfer energy at the rate of 1 W between opposite faces of a 1-cm. cube.

TABLE I.—Thermal Conductivities and Resistivities.

	Conductivity in watts per sq. cm. per deg. C. per cm.	Resistivity in "thermal ohms" or deg. C. per cm. per watt per sq. cm.
Copper	3.9	0.26
Aluminium	2.0	0.5
Iron	0.5	2
Iron sheet, parallel	0.2–0.6	1.7–3.5
Iron sheet, perpendicular	0.005–0.012	83–200
Quartz, crystalline	0.126–0.065	7.9–15.4
Quartz, amorphous	0.0126	80
Glass, porcelain	0.012–0.005	84–200
Mica	0.0036	280–400
Micanite	0.0012	830–1,000
Ebonite	0.00164	620–720
Presspahn, varnished	0.0014	715–1,200
Presspahn, oil-impregnated	0.0025	400–800
Paper	0.0013	770–2,000
Paper, varnish-impregnated	0.062–0.0015	600–800
Rosin	0.0075	1,320
Styrol	0.0011	918
Aniline resin	0.00067	1,500
Cotton	0.00069	1,450
Cotton, varnish-impregnated	0.0025	400–800
Cambric, varnished	0.0015	700–800
Sand	0.0025	400–1,500
Sealing compound	0.00096	1,040
Thin layer of air	0.005	2,000–4,000

The advantage of expressing the thermal properties of the electrical insulation in terms of thermal resistance lies in the fact that it is then possible to use a thermal analogy to Ohm's Law, viz.: $\Delta t°=RQ$; where $\Delta t°$=temperature difference, *i.e.*, temperature rise, in deg. C.; R=thermal resistance=deg. C. per cm. per watt per sq. cm.×thickness in cm./area in sq. cm.; and Q=heat flow=iron and copper loss in watts.

Where heat flows from the surface into air or liquid there is a surface resistance, the specific value of which per sq. cm.=total surface resistance×area of surface in sq. cm. Thus the surface resistance between metal and air with 40 deg. C. difference of temperature is 800 "thermal ohms," and the requisite cooling surface is 20 sq. cm. per watt dissipated. In calculating the temperature rise from the above equation, the "thermal resistances" are treated like ohmic resistances, *i.e.*, added if heat flows through them in series, and combined in the same way as parallel resistances if heat flows through different resistances in different directions.

TABLE II.—Thermal Resistivity of Materials with Crystalline Additions.

	Thermal ohms.		Thermal ohms.
Ebonite	700	Oil:	
+ 50 per cent. quartz sand	450	Heavy	800–1,000
Aniline resin	1,500	Transformer, poor circln.	500–800
+ 50 per cent. ground quartz	543	Transformer, good circln.	240–320
+ 80 per cent. ground quartz	380	Sand-filled	180–200
+ 80 per cent. sand	300	Sealing compound	1,040
+ 90 per cent. sand	202	+ 75 per cent. ground quartz (under 0.1 mm.)	510
+ 50 per cent. asbestos	455	+ 75 per cent. sand (under 0.1 mm.)	285
+ 70 per cent. asbestos	345	+ 75 per cent. sand (under 0.4 mm.)	186
+ 80 per cent. asbestos	300	+ 92 per cent. sand (under 0.4 mm.)	140
Styrol	918		
+ 60 per cent. sand	388		
+ 80 per cent. sand	260		

Table I gives values for the thermal conductivity and resistivity of a number of insulating materials and certain metals for comparison. Table II shows the thermal resistivities of various insulating materials and the reductions effected therein by stated additions of crystalline material. Mechanical considerations restrict the addition of quartz sand to ebonite to about 50 per cent., and the reduction in thermal resistivity is therefore relatively small. With aniline resin, however, the thermal resistivity can be reduced in ratios from 1 : 5 to 1 : 7 by additions of quartz, but additions of asbestos are often preferred in the interests of easier machinability; 75 per cent. asbestos-filling gives a useful product with 20 to 25 per cent. of the normal thermal resistivity. Sand-filling increases the thermal conductivity of oil more effectively than the best circulation.

The Use of Sand

Owing to the high dielectric strength of sand, the breakdown strength of sand-loaded sealing compound (table II) is from 200-400 kV per cm. (1 cm.=0.39 in.) or higher, according to the quality of the compound itself; and the breakdown strength is still above 150 kV per cm. at 100 deg. C. Though the thermal resistance decreases as the proportion of quartz sand is increased, the compound becomes less elastic and more difficult to pour. With less than 60 per cent. sand, the filling settles unless cooling be very rapid, but no appreciable separation occurs when the compound contains 75 per cent. quartz. Additions of bitumen reduce the separation occurring in compound with a low percentage of quartz, the pyroelectric property of the latter resulting in the formation of a sheath of bitumen round each grain. This, however, reduces the thermal conductivity. Best results are obtained with from 20 to 40 per cent. bitumen, avoiding high thermal resistance due to settlement on the one hand and undue lagging on the other.

Quartz-loading to the extent of 75-85 per cent. reduces the thermal expansion of sealing compound to practically zero or to less than half that of the ordinary compound, according to the range of temperature concerned. Increasing the bitumen-content, however, increases the expansion. Other physical properties of the quartz-loaded compound (bracketed values refer to ordinary compound) are: Flash point 250 deg. C. (210 deg. C.) fire test 317 deg. C. (260 deg. C.); melting or softening point 95 deg. C. (54 deg. C.); dielectric constant 3.9 (2.8); dielectric loss, under 0.03; sp. gr. 1.95 (0.96 to 1.1). Additions of diphenyl chloride render the mass incombustible, an endothermic action occurring when the chloride is heated which checks combustion. From 1 to 2½ per cent. of the chloride by weight improves the arc-test considerably.

New principles of design must be observed if full advantage is to be taken of increased thermal conductivity in the electrical insulation to increase the rating of apparatus. In particular, insulation of low conductivity should only be used parallel to the flow of heat, a low-resistance path from the inside to the outside of the apparatus being provided through

high-conductivity material. By reducing the internal heat resistance, possibly to from 0.5 to 0.2 of its normal value, the temperature gradient between conductor and insulation may be made less than that at the surface; in other words, the limiting factor is the transitional resistance between insulation and air, instead of the internal heat resistance. By increasing the metallic cooling surface in contact with air, the outer thermal resistance can also be reduced.

All the metal surfaces of the apparatus should, if possible, be in good thermal contact with the heat-conducting electrical insulation. In some instances, the cooling system may be increased by adding external surface of any convenient metal.

The materials and principles mentioned above have been applied very successfully to d.c. electro-magnets and field coils. For example, the loading of loud-speaker magnet coils can be increased considerably by the use of thin layers of high-conductivity quartz compound to transfer the heat to a larger cooling system; a new construction on this principle attains a steady temperature of 40 deg. C. in 5 hr. compared with 70 deg. C. in the original construction without quartz. The use of quartz compound between the casing and the coil of a brake magnet increased the rating from 200 to 350 W for the same temperature rise, thus making possible a 40 per cent. saving of copper; similarly, the rating of a lifting magnet was increased from 380 to 850 W corresponding to a saving of copper of about 50 per cent. By sinking the winding of a pot magnet in the annular space filled with quartz compound, the outer surface of the pot being in good contact with the metalwork of the surrounding structure, the amount of copper may be reduced to one-fifth of that required by the equivalent magnet with unassisted cooling.

Other applications of sand-loaded compound include contactor, switch and relay coils, track-brake magnets (60 per cent. saving of copper and 20 per cent. saving of iron), and magnetic chucks (50 per cent. saving of copper and 11 per cent. saving of iron, greater holding power, and freedom from cracks and cavities due to expansion and contraction). A certain transformer rated at 1.8 kW with air-cooling carries 3.2 kW for the same temperature rise when immersed in quartz compound and provided with cooling ribs.

The complete enclosure of a transformer in quartz compound eliminates the necessity of providing an expansion vessel, as where oil is used; also, the cable connections can be embedded in the compound giving a construction which is very suitable for mining and similar service. The overall dimensions are reduced, humming is eliminated, and the weight of combustible insulation is reduced to one-quarter. Attempts have been made to use insulation at higher temperatures, but it is considered preferable to obtain increased ratings by limiting the temperature of the condenser to about 100 to 150 deg. C., and to increase the heat flow by raising the thermal conductivity of the insulation.

The Droitwich Broadcasting Station

B.B.C. engineers describe the 150-kW long-wave transmitter

THE radio-telephony plant of the British Broadcasting Corporation at Droitwich is described in a paper by Messrs. N. Ashbridge, H. Bishop, and B. N. MacLartz, which was read at the Institution of Electrical Engineers in London on April 11th. The 150-kW long-wave transmitter is dealt with in greater detal than the 50-kW medium-wave transmitter.

The first part of the paper deals with the objects and required performance of the station, and the effect of governmental and international regulations relating to broadcasting stations, particularly in connection with power and the choice of site. Part II is a general explanation of the lay-out and the reasons for adopting certain types of plant. Part III is mainly concerned with the detailed design of certain apparatus not yet in common use in stations of this kind, such as mercury-arc rectifiers for an output of 600 kW at 20,000 V and motor-generator sets with four commutators (two per machine) in series for a similar output.

An essential feature of these steel-tank B.T.H. rectifiers is that d.c. short-circuits, such as may occur in the event of a flash-arc in a transmitting valve, are quickly suppressed by applying negative voltage to the grids of the rectifiers. On account of the wide range of normal operation induction-regulator control of voltage is provided; and, in order to simplify the control scheme and to prevent surges in the smoothing circuit when switching in, the regulators are capable of varying the voltage from 20,000 V down to nearly zero.

Grid Control

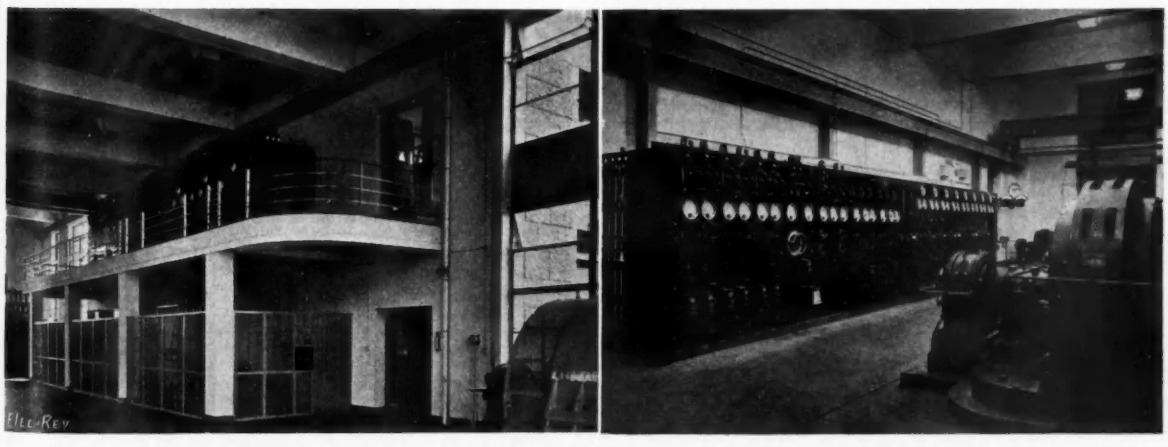
The rectifiers are provided with control grids for arc suppression, but the grid impulses are timed to give maximum voltage, and all voltage control is effected by the main induction regulator. The apparatus for grid control consists of a small peaking transformer for applying positive voltage to the grids at the correct phase instants, a small phase-shifting induction regulator for control purposes, and a motor-generator for furnishing a negative d.c. bias voltage for the grids. The phase-shifting regulator is geared to the main induction regulator in such a manner that the a.c. voltage applied to the control grids is maintained constant in magnitude and in fixed phase relationship to the voltage applied to the anodes, irrespective of the magnitude of that voltage.

In the event of an overload on the rectifier a high-speed relay in the grid-control circuit transfers the grid circuits from the normal source of supply to a source of constant negative potential of increased value. By this means, when the current in each of the anodes reaches zero the arc is prevented from restriking on that anode, and in this way the total short-circuit current is quickly suppressed, without inducing any voltage into the load circuit higher than the normal working voltage.

The rectifier auxiliaries all operate at the same potential as the rectifier tank, which may be at 20,000 V (d.c.) above earth potential. To avoid the use of independent insulating transformers for each of these components, it was decided to feed them through a common insulating transformer and to perform switching operations through insulating links. The high-voltage control panels and the rectifiers themselves are mounted on tall porcelain insulators, while for the cooling-water supply and mercury pump the necessary insulation to earth is provided by long coils of rubber hose-pipe mounted on porcelain insulators.

The full-load overall efficiency of the complete equipments exceeds 93 per cent. at 12,000 V, 94 per cent. at 15,000 V, and 95 per cent. at 20,000 V.

Each of the two 12,000-V motor-generator sets has two commutators in series, the associated windings being accommodated in the same slots. They are constructed on the graded-



Two views of the Droitwich plant: Left, the machine room showing one mercury-arc rectifier enclosure and power switchboard. Right, the switchboard and part of one of the motor-generators

potential system developed by the English Electric Co. The armature core is insulated from the earthed shaft to remove the heavy electrical stress from the slot insulation. The core insulation consists of four pressed-mica sectors, each 0.25 in. thick. The shaft forging within the armature is of square form, the edges being bevelled off to provide flats to match the mica sectors. To locate the armature core at a potential midway between that produced by the two windings in series, the armature core is connected by means of a slip-ring and brush to the interconnection between the two commutators. On one machine the hub insulation mentioned above must withstand a potential of 15,000 V when the machines are connected in series to produce 20,000 V. The mica sectors are therefore provided with large overlaps and creepage distances at the extremities of the core. This insulation has been tested at 30,000 V (a.c) for fifteen minutes. The armature hub is of cast steel, made in two halves, held together by bolts which also pull the hub down to the mica shaft insulation.

The stress between adjacent coils and between coils and slots cannot exceed 6,000 V, but in the series-connected condition there exists in the case of one machine a potential of 15,000 V between the armature core and the pole-faces. To withstand this an air-gap of approximately 0.76 in. is provided; further, the pole faces are covered with bakelite shields, which are themselves capable of withstanding the full voltage.

The generators have separately excited fields supplied by 220-V overhung exciters. The motor-operated field regulators control the voltage from 1,000 to 12,000 V in steps not exceeding 200 V. The overall efficiency of these sets as measured on the test load is 86 per cent.

Protection Methods

Generators of this type may be protected against overload by a high-speed field contactor, the actuating coil of which is connected in series with the main armature lead. While such a device might be satisfactory for the protection of the generators themselves, the rate of decay of the main field flux is relatively slow and, moreover, the energy stored in the main smoothing choke tends to keep the fault current flowing for several seconds. A 20,000-V d.c. circuit-breaker would be cumbersome and expensive.

Tests proved that commercial types of fuses were definitely not satisfactory unless the peak current was limited to 20-30 A in spite of the fact that certain of the fuses tested would successfully clear a.c. circuits operating at 132 kV. (Fuses of the carbon-tetrachloride type are in use for the protection of individual valves in the medium-wave transmitter, and are satisfactory in operation, since a series limiting resistance is used.) It was decided, therefore, that the most satisfactory method of protecting the transmitting valves and associated apparatus was to short-circuit the generators through a 5-henry smoothing choke and simultaneously break the field circuit of the generator, which has proved to be satisfactory.

Current on the load side is reduced to zero in 1/50th sec. from the moment the short-circuit is applied, the peak being of the order of 240 A. The short-circuit current in the armature smoothing choke circuit takes at least 5 sec. from the moment of short-circuit to die down to the normal short-circuit current, owing to the residual field of the machine.

Such a method of protection may appear to be drastic from the generator's point of view, but the peak current due to a flash-arc is at least as great as that caused by the short-circuiting device, and it is essential to prevent damage to the transmitter itself. Further, the heavy voltage-surge due to a self-quenching flash-arc is entirely obviated by this method of protection.

Transmitter Circuit

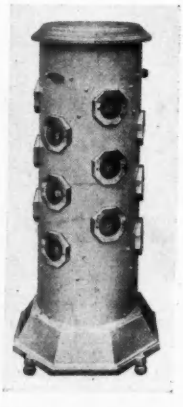
The Marconi method of " series modulation " and the design of the aerial compensating network and harmonic filter used for the long-wave transmitter are considered at some length. A transmitter of 150-kW carrier output can be satisfactorily modulated at low power level, but to prevent serious side-band cut-off, particularly at the relatively long wavelengths, the circuits of the modulated high-frequency stages would be of a complicated design, and critical to adjust. Conversely, if the foregoing difficulties were avoided by anode-voltage modulation of the final amplifier even greater difficulties would be encountered in the design of iron-core inductances or transformers capable of handling such large amounts of energy without the introduction of serious distortion.

It was decided to avoid the difficulties mentioned above by modulating the penultimate amplifier by means of series-connected modulators. This well-known but seldom-used arrangement avoids the use of iron-core apparatus in any of the low-frequency circuits and, moreover, it reduces the number of amplifying stages subject to modulation to one only. An additional advantage associated with series-connected modulators, suspected during preliminary considerations and proved during subsequent experiments, is the reduction of distortion combined with more faithful reproduction of transient wave-forms compared with that obtained from choke-connected modulators.

The difference can be attributed mainly to the presence of iron in the magnetic circuit of the speech choke, but further investigation into the matter is necessary before the authors will be prepared to assign exact reasons for the difference in performance of the two systems.

Electrical News from France

A MESSAGE from our Paris Correspondent states that it has been decided to double the 220-kV line from Mareges to Paris. The new line will comprise three steel-core aluminium cables of a section of 350 sq. mm. and will be able to carry a normal load of 10,000 kW. It will be about 74¼ miles long. Following negotiations between the Ministry of Public Works and the Compagnie Parisienne de Distribution d'Electricité, the company has decided to make a cut in its rates for commercial users, to take effect from January 1st last. The total energy used is to be divided for this purpose into three parts. The first part, representing 500 hours' use of the contract load, will be paid for at the usual rates; the second part, representing from 500 to 900 hours' use, will be charged at 15 per cent. less than the regular rate; the charge for all over 900 hours will be reduced by 40 per cent. It is estimated that the modified tariff will benefit consumers to the extent of 20 million fr. per annum.



An electric brazier

Production figures for 1934 of the Energie Electrique du Rhine show a very considerable jump in production, the total being 363,047,771 kWh, as compared with 154,768,000 kWh during 1933. The Union d'Electricité, which controls a number of large plants in the centre of France, also shows an improvement in production figures for 1934. The total output amounted to 1,568,559,400 kWh, against 1,501,009,800 kWh in 1933. The plant of this company is principally hydro-electric. The Sud Lumière Company, which operates in the region of Paris, also reports an improved consumption for the past year. Both its production and its gross revenue increased by 10 per cent.

The work of rebuilding portions of the electrical distribution network of Grenoble has begun. The plans call for the expenditure of 30 million francs over a period of five years for the modernisation of equipment and the improvement of the system. The new hydro-electric power plant at La Chatre is one of the best examples of distant control of power plant in France. A line 5 km. long and comprising five conductors has been run to the plant at Chatelus. Either or both of the two 3,300-kVA 10,000-V alternators can be put into service by a single operation from the Chatelus station. The various operations include opening the water gates to let the water into the turbine, starting the turbine, exciting the alternator, and synchronisation.

A New Brazier

An electric heating device in the form of a brazier has lately been put on the market by Chaboche & Cie, of 33, Rue Rodier, Paris. The brazier consists of a covered sheet-metal cylinder, about 39 in. in height and 12 in. in diameter, mounted on a 14-in. base. The cylinder is provided with eighteen openings, in six rows of three, in which are fitted as many heating elements, somewhat similar to those used in bowl fires. The elements are fitted into suitable slots in a framework within the cylinder, to which the necessary electrical connections are made, with convex grooved fronts, the resistance wire being laid in the grooves, while surrounding the elements are small chromium-plated reflectors.

The total loading is 4 kW, and the brazier is made for use on either 100- or 200-V circuits; in the case of single-phase power, control switches are provided which enable either six, twelve, or the whole eighteen elements to be used, while for three-phase circuits only two switches are furnished, each controlling nine elements. A further heat control is provided by a switch-operated internally located resistance, by means of which the elements may operate at two degrees of heat—either dull or bright red.

MEETINGS AND DISCUSSIONS

Current Topics and Opinions Expressed at the Institutions

Two New Measuring Instruments

TWO papers by Dr. H. E. M. Barlow were discussed by the Meter and Instrument Section of the INSTITUTION OF ELECTRICAL ENGINEERS in London on April 5th. The first paper describes an a.c. milliammeter having four ranges, namely, 5, 10, 20, and 30 mA and suitable for measurements at any frequency between 25 and 5×10^6 cycles per second.

The instrument depends for its action on the use of a two-electrode thermionic valve operating under saturated conditions in conjunction with a moving-coil galvanometer. The ability of this instrument to respond to small alternating currents depends upon the very rapid increase which occurs in the saturation current taken from the filament of a thermionic valve when its temperature is raised by a small amount. The a.c. passes through the filament of the same thermionic valve in all cases, so that on the lowest range the overload capacity amounts to 1,000 per cent. or more, and the resistance of the instrument is only about 35 ohms when employing an ordinary commercial valve, or about 15 ohms when employing a valve specially constructed by the General Electric Co., Ltd.; H. Tinsley & Co. developed the instrument in a practical form.

Since the d.c. through the filament of the valve is only about 50 or 60 per cent. of the rated heating current, and the a.c. is generally relatively small, it follows that the instrument must have a large overload capacity, particularly on the lower ranges. This is a very valuable asset when comparing the merits of the instrument with other high-frequency current-measuring devices. Moreover, it is quite easy to provide four or five different ranges on the one instrument, making it available for measuring currents up to ten times the full-scale value on the lowest range, and in no case is the a.c. impedance greater than about 40 ohms.

Another important advantage of the valve ammeter is its rapid response. Thermal-couple instruments of similar range are always very sluggish in their action, presumably owing to the effect of the thermal couple shunting the galvanometer and giving excessive damping. Thermal-couple instruments are frequently burnt out as the result of an overload without the galvanometer needle having shown any appreciable deflection.

In the second paper Dr. Barlow describes a permanent-magnet device for enabling a more uniform division of the scale of a.c. indicating instruments to be readily obtained without recourse to any special design of operating mechanism, or modification thereof.

The deflecting torque of a.c. ammeters and voltmeters is normally proportional to the square of the quantity which it is required to measure. With the ordinary type of restoring force provided by a mechanical torsion system, such as a twisted fibre or a spiral spring, the torque tending to bring the moving part back to its zero position is directly proportional to the angular displacement. Thus the scale of such an instrument follows a square law, the divisions being crowded together at the lower end. If, on the other hand, a restoring torque proportional approximately to the square of the displacement is provided, a more uniformly divided scale naturally follows.

The required conditions can be closely approached by using the repulsion between like poles of two magnets to give the greater part of the restoring force. Two small permanent magnets of cobalt steel, aluminium-nickel alloy, or some such material having a high coercive force, can be conveniently employed, one being fixed to the frame of the instrument and the other mounted on the moving part so that it is brought into closer proximity with the fixed magnet as the deflection increases.

Owing to possible disturbances due to iron or external magnetic fields in the immediate neighbourhood of these control magnets, the apparatus is particularly suitable for application to electrostatic voltmeters, and the paper is mainly concerned with the results obtained in the case of instruments of that type.

The application of magnetic control to deflection instruments is not new. The moving-magnet instrument is an example of much the same idea. It is, however, only recently that the particular scheme advocated has become practicable. The advent of cobalt steel and, still more recently, aluminium-nickel alloys has really made this development possible. These alloys have a remarkably high coercivity and retain their magnetism for an indefinite period almost unimpaired. Even magnets of very short length are exceedingly reliable in this respect, and there is no reason to expect any appreciable change with time in the calibration of instruments which are fitted with magnetic control.

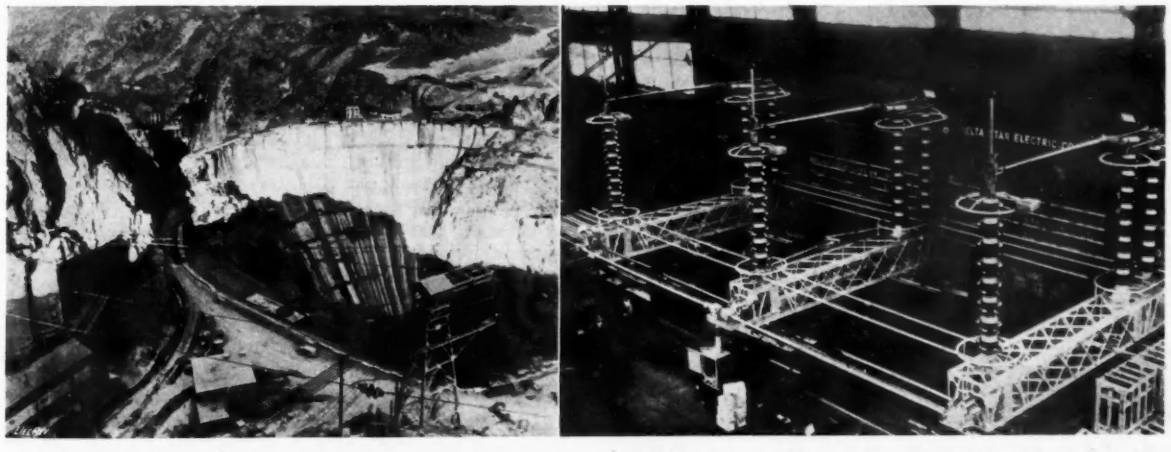
Distribution Legislation and Regulations

ELECTRICITY undertakings are essentially what the law makes them, says Mr. W. Fennell in the paper which he read before the Transmission Section of the INSTITUTION OF ELECTRICAL ENGINEERS in London on April 10th.

The effect of recent legislation (1919-1926) has been almost entirely that of improving generation, leaving distribution in much the same legal position as in 1899. The "paralysing" effect of the 1888 purchase terms upon companies approaching the purchase date is demonstrated, and the unsuitability of the 1926 Act (Section 39) with regard to provisions for companies with large areas is indicated.

Remedies are difficult to find at a time when purchase is expected by both sides. The author's view is that in the case of existing Orders the local authority should be required to enter into a contract to purchase at the end of the fixed period and should be required to provide the capital for all extensions for the last twenty years upon the standard municipal-loan terms, the outstanding loan to be a first charge on the purchase price. Failing that, the right to purchase under the 1888 terms should lapse, and any purchase should be effected by valuation of the undertaking as a going concern. For new Orders, purchase should be at any time after twenty-one years on the basis of value as a going concern. As a safeguard to the consumer, it would be fair to limit the "profit." An alternative might be the sliding scale, introduced into the bargain made with the London companies under similar circumstances in 1924.

The question at issue is whether there is such a great



Good progress is being made with the Boulder Dam (California) hydro-electric undertaking. The left-hand picture shows the constructional work proceeding and that on the right illustrates a 287-kV motor-operated switch weighing 15 tons, one of sixteen being made by the Delta Star Electric Co.

difference between London and provincial conditions as to provide a *prima facie* reason for continuing the uncertainty and stagnation which result from the 1888 Act terms in relation to the older provincial company undertakings, when these conditions have been brought to an end so far as London is concerned.

Companies should not be compelled to make high charges in order to accumulate huge reserves to guard against loss of their shareholders' capital on a hazardous purchase basis at an uncertain date.

There is to-day no reason why a local authority should have the right to more than the initial preference in relation to distribution, and the one definite option (at forty-two years, or other agreed period) of purchase of existing undertakings.

The most important effect which the 1926 Act has upon distribution is indirect, but none the less revolutionary. For the first time, there is established for most undertakings a fixed basis of cost for electricity delivered to a convenient centre in each area.

The moulding effect of the grid tariff upon the form of retail tariffs is brought out and the potential advantages of the grid in encouraging new undertakings are suggested. The beneficial effect upon the cost of distribution resulting from the ability to lay out systems and bring in bulk supplies without reference to the best site for a power station is obvious.

Standardisation of Retail Charges

The author is aware of no system which complies even approximately with the ideal requirements for a fixed charge. This problem is a most important one in relation to future legislation, because the legalisation of the grid two-part tariff, and the absence of even an alternative grid flat rate, make it not merely a logical step, but a matter of justice to the retailer to enable him to pass on to the consumer a two-part tariff corresponding to the cost basis, and to refuse flat rates as alternatives.

The author suggests a simplification and cutting down of the 1934 Edition of the Electricity Commissioners' Regulations. Improvement is hindered, if not barred, in proportion as details instead of principles are specified. He is of opinion that a consolidating Act is required, embodying all those features of the Electricity Supply Acts that have worked well; amending those which have proved to be weak; rectifying those which have been spoiled by decisions of judges; and adding others with the object of shortening procedure, providing facilities, and removing obstacles to progress. Among the items which need revision are purchase clauses for company undertakings.

Section 21 of the 1919 Act relating to local authorities and overhead lines should be amended to allow of consents being given by the Minister of Transport for areas, as an alternative to consents for each specific line. This would save much expense and delay in rural areas. Section 22 (1) of the 1919 Act relating to the position of owners and occupiers regarding wayleaves, &c., should restore to the Minister of Transport the power of deciding wayleave rentals.

The 1926 Act requires revision in relation to indirect grid supplies and the position of power companies and joint electricity authorities in preventing direct supplies being obtained from the grid where they might be given at lower cost.

Voltage and system standardisation should be on a basis which spreads the cost between (*a*) the Electricity Commissioners (as in the case of frequency standardisation), (*b*) the undertakers, and (*c*) the consumer; in the proportion in which (i) the country, (ii) the undertaking, and (iii) the consumer, benefits. The costs borne by (*a*) should be refunded by the State and (*c*) could be recovered by special unit charges to cover principal and interest on Government loans.

Parish boundaries should no longer be considered to be the boundaries of distribution areas; within three years equitable exchanges of fringes might be arranged. Assessment for local rates on a basis more severe than that of the ordinary trader is inconsistent with the desired cheap supply of electricity; reform is overdue.

Undertakers should be required to extend their distribution into every parish in their areas to the satisfaction of the Electricity Commissioners within three to five years, according to location, failing which the powers for undeveloped areas should be transferred to other undertakings, and where this is impossible "isolated plant" should be established and operated by the undertakers on the order of the Commissioners. Flat rates, not two-part tariffs, should be optional.

Both local authorities and companies should be required to provide hiring schemes—on a basis of a percentage rent on cost—for wiring, grills, cookers, wash-boilers, water heaters, and small motors. The basis should be one which shows no net profit after allowing for interest at, say, 6 per cent., depreciation, and maintenance at a rate to be settled by the Commissioners from time to time.

Compensation to the older employés displaced by reorganisation and unable to obtain equivalent positions should be more liberal. Preference should be given by the Central Electricity Board and all undertakings to displaced employés, and the onus should be placed upon them to prove that suitable men already in the industry are not available before they appoint men from outside. There should be a limit upon the profit of company undertakers.

More detailed provision should be made for forming joint electricity authorities for area control and/or operation of distribution by an amplification of Sections 36-38 of the 1926 Act. A return by the Electricity Commissioners to their original policy (1919 Act), with the compulsory powers for formation and finance provided by the 1926 Act (Sections 36-38), but for distribution only, would react very beneficially upon public opinion, which is to-day being moulded by agitation into a condition of severe criticism.

Peat Possibilities in Ireland

As it became known in Dublin during the past few weeks that Mr. Allan Monkhouse was to read his paper on "Electrical Developments in the U.S.S.R." interest grew to such an extent that the venue had to be changed three times to provide sufficient accommodation. In the end the meeting became a joint one between the Irish Centre of the Institution of Electrical Engineers and the Institution of Civil Engineers of Ireland, and was held at the Mansion House on April 5th. Well over 500 people were present, and the chair was taken by Mr. Séan McEntee, Minister for Finance, who was a consulting electrical engineer before he took office.

As the audience approached the Mansion House leaflets, issued by the Communist Party of Ireland, were distributed alleging that the author was an anti-Soviet propagandist. It is to be hoped that the persons who contrived this clumsy piece of propaganda for their own party have either read the paper since or heard Mr. Monkhouse deliver his lecture, for there could be no more convincing proof that the U.S.S.R. has been successful in the planning and execution of its electrical development. Certainly nowhere else in the world has such progress in that direction been made in any single decade. Even so, provision for the demand for industrial power cannot be made fast enough, so that domestic electrification has had to be checked and consumption actually curtailed. In spite of that, and of the obvious fact that only a relatively small area of that extensive country is supplied, the present rate of consumption per head of total population (170 millions) is greater than the rate per head in Ireland.

Lenin had the foresight to push ahead with electrical development some years before the first Five-Year Plan was started as he knew that the success of that plan depended mainly upon the provision of ample power widely spread.

The Irish audience was chiefly eager to hear what Mr. Monkhouse had to say about the production and use of peat in Russia, and it went away feeling certain that the Irish bogs are fit to be put to the same beneficial use as the bogs of Russia.

It is said that Mr. Monkhouse met the delegation which the I.F.S. Government is sending this spring to Germany and Russia, and it is probable that his paper was responsible for Russia being included in the itinerary. Some £2½ millions worth of coal is imported yearly into the Free State, and an effort has been made during the last two years by the Turf

This is a view of the interesting Arts and Crafts Exhibition arranged by employés of the London Electric Wire Co. & Smiths, Ltd. (See page 535)

Development Board to replace some part of that by hand-won turf for general domestic and office use, but it is thought that the practical results have not been entirely satisfactory.

It was not surprising, therefore, to hear Mr. McEntee and Mr. R. C. Barton (chairman of the Turf Board) speaking appreciatively of the Russian developments. Prof. Purcell, of the Fuel Branch of the Industrial Research Council, spoke of the large new enterprise which is starting work this spring on a bog at Ticknevin, Co. Kildare, with machinery for producing the milled peat mentioned by Mr. Monkhouse.

Mr. Monkhouse said that this milled peat runs in size from dust to about ¾ in., and is fed into the boiler furnace rather like pulverised fuel, being "floated" in the combustion zone by an upward draught, little of it reaching the moving grate. The fuel is pre-dried by hot gases on its way from the bunker to the boiler.

Changing-over from D.C. to A.C.

AT the informal meeting of the Institution of Electrical Engineers in London on April 1st a discussion on distribution system change-over was opened by Mr. H. Brierley, who spoke from the supply authority's point of view, and by Mr. A. F. W. Richards, who represented the consumer.

Mr. Brierley said that the amount of copper required in a four-wire three-phase distribution network carrying a normal unbalanced load was less than that required in an equivalent three-wire d.c. network, and the capital cost of mains was less. Except in comparatively small towns or districts, a d.c. system could not be supplied direct from the generating station or one central sub-station. Rotary-convertor or rectifier sub-stations must be provided and the cost of building and equipping these was much higher than in the case of static sub-stations, maintenance and operation costs were higher, and the conversion losses were greater.

The a.c. system was more flexible. The insertion of an additional static sub-station was a cheaper and more efficient method of coping with increasing loads than the provision of additional converting equipment together with additional heavy d.c. feeder cables. Owing to the absence of electrolysis and osmosis the life of cables on an a.c. network was longer than on a d.c. network, faults were fewer, and maintenance costs were lower. A.c. meters were cheaper in first cost and would commence to register on lighter loads than d.c. meters, resulting in increased revenue to the undertaking.

Many undertakings had single-phase 200/400-V distribution systems and were now more or less actively engaged in changing the pressure to 230/460 V. No alteration to their mains was required and little alteration was necessary inside the sub-stations; auto-transformers stepping up from 200/400 to 230/460 V were required if the existing transformers were not provided with tappings at both these pressures, but heavy expenditure was called for in changing consumers' apparatus. In return the undertaking obtained a 15 per cent. increase in the load capacity and value of its distribution system, which offset to a large extent the cost of change-over. Other undertakings were distributing at 240 or 250 V, and in those cases any advantage obtained by changing to the standard 230 V appeared to lie entirely with the consumers.

Mr. Brierley described the procedure adopted for converting consumers' apparatus and explained the obligations of the authority and of the user.

Mr. A. F. W. Richards said there was not always enough readiness to pass on to the consumer the benefits derived from standardisation, nor were the blessings quite unmixed. In particular, he referred to the life of lamps and of hot-wire apparatus working at higher voltages. Consumers had been led to expect all sorts of advantages, which benefits might be assured for the future, but they did not come automatically with the change-over. He thought a grave blunder had been made in allowing the retention of 220-V and 240-V supplies. He also criticised the method frequently adopted of balancing sections of a house, sometimes sections of a room even, having a pressure of 460 V between them.

Mr. A. F. Harmer said the change-over had been made to appear a simple matter, but it was not at all easy. The job of the supply authority was largely one of organisation, but the great difficulty was in dealing with consumers. The user had to be converted; he was not interested in the national advantages. He was naturally concerned to get benefit for himself from the alteration.

Mr. R. H. Rawll illustrated his remarks with a number of slides showing the nature of the work involved in changing the frequency of supply in the industrial area of Birmingham. His remarks clearly demonstrated the immensity of the task.

Fixing Domestic Tariffs. By S. F. Osborn

IF a domestic two-part tariff is offered as an alternative to the high flat-rate charge for lighting the standing charge should approximate to the consumer's previous lighting cost, and should be equal to that which he would have to pay for any equivalent alternative service. The flat rate for lighting should cover the standing charges of the cost of production, so that the fixed charge on a two-part tariff based purely on the consumer's consumption should be equally as acceptable to the undertaking as to the consumer.

The magnitude of the lighting bill depends mainly on the size of the house and the use made of the various rooms. With the rateable value (or Norwich) system, if the valuation per sq. ft. of floor area is greater for the better-class districts the consumer has to pay more for his lighting supply. For this reason a standing charge fixed purely on rateable value is not always acceptable.

A combination of the size of the house and the use made of the rooms can be said to give a close approximation to the lighting consumption for the average household, and, while it is adopted to some extent by a few undertakings by charging less per W installed in their assessments for lamps in halls, passages, and rooms where light is little used, the basis is estimated consumption rather than results that have been obtained experimentally.

For this purpose use can be made of the results which have been obtained by certain undertakings in France, where the standing charge takes the form of a small surtax per kWh sold. The tests were made by separately metering the electricity supplied to each room of each of a number of dwellings of various types and sizes for a year. The tests, together with a few similar experiments carried out in this country, show that the consumption per room of the average type of house can be apportioned in the following ratios: Kitchen, 25; sitting room, 20; dining room, 10; first two bedrooms, 8; bathroom, 6; other bedrooms, 4; halls and landings, 4; larders, 4. In houses which have both kitchen and scullery the proportions should be taken as 15 for each.

To arrive at the correct standing charge the rooms are assessed with regard to size and the intensity of light required. The wattage considered necessary for satisfactory illumination is then multiplied by the corresponding room factor. The products thus obtained for all the rooms are totalled, and the resulting figure is taken as the assessment for the standing charge. The figure is multiplied by a suitable fixed charge per 100 of the assessment figure.

The accompanying tables show the standing charges for a small and a large type of house, comparing the standing charge based on installed demand only with the standing charge based on installed demand and the room factor. The running charge would be ¾d. per kWh, and the standing charges are fixed as an alternative to a flat rate of 6d. per kWh. For other flat rates the standing charge may be adjusted accordingly.

SMALL HOUSE.

	Watts installed.	Room factor.	W × room factor.
Kitchen	60	25	1,500
Sitting room	100	20	2,000
Bathroom	40	6	240
Hall	25	4	100
Landing	25	4	100
Bedroom	100	8	800
Bedroom	60	8	480
	410		5,220

Standing charge at 20s. per 100 W (to nearest 100) = £4 per annum. Standing charge at 2s. per 100 of assessment figure = £5 4s. 6d. per annum.

LARGE HOUSE.

	Watts installed.	Room factor.	W × room factor.
Kitchen	40	15	600
Scullery	40	15	600
Dining room	100	10	1,000
Sitting room	100	20	2,000
Hall	60	4	240
Landing	40	4	160
Bath room	60	6	360
Bedroom	100	8	800
Bedroom	100	8	800
Bedroom	100	4	400
Bedroom	60	4	240
	800		7,200

Standing charge at 20s. per 100 W = £8 per annum. Standing charge at 2s. per 100 of assessment figure = £7 4s. per annum.

This system has the effect of reducing the standing charge on large houses having a number of rooms which are not often used. It increases the standing charge for supplies to small houses where electricity is normally obtained for lighting on a two-part tariff at a figure below that which they would have to pay on the flat rate. At the same time, if the standing charges are correctly fixed, the total price obtained by the undertaking would be approximately the same as that obtained on the flat rate.

Correspondence

Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession

Does Registration Mean Anything?

As a registered contractor I have been interested in the correspondence upon this subject and I should just like to inform your anonymous correspondents (if they are contractors) that they are not improving their own positions and no good purpose can be served by belittling registration.

Of course, registration means something, and I venture to predict that it will mean a great deal more in the none-too-distant future, and so long as I remain an electrical contractor I shall do all that lies in my power to hasten legislation to enforce registration. The Register is an excellent institution which has been formed in the same small way as, say, the Institution of Electrical Engineers, which was established sixty-four years ago. The Register is an "infant" compared with the Institution, and speedy results can hardly be expected.

With regard to your correspondents' complaints, I would suggest that they send in their application forms for registration together with the facts in their possession regarding shoddy work carried out by registered contractors, and I feel certain that the committee will deal with any alleged culprits in a manner that will surprise our unregistered friends.

Personally, I have derived no personal gain by being registered, and I am aware of the hordes of parasites in the contracting industry. But I am optimistic enough to believe that the Register can and will be eventually the salvation of the industry if all contractors will put their shoulders to the wheel and each individual member perform his little share of duty necessary to attain the goal of compulsory registration and legal enforcement of the rules and regulations.

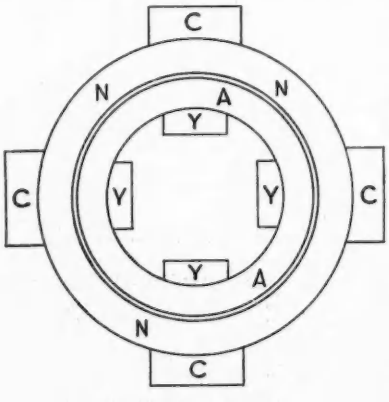
Glasgow, *April 6th*. Alex. Milne.

The Magnetic Field

In his article on magnetic fields and electromagnetic induction, appearing in your issue of April 5th, Prof. Howe states, with regard to the hypothesis of moving magnetic lines, that "such an assumption enables one to explain the observed facts and cannot be disproved by experiment."

This assumption when applied to a single-phase transformer implies that the induced e.m.f. in the secondary is zero when the primary magnetising current is zero, whereas according to the varying linkage theory and all teaching on the subject it is a maximum at this instant. Also, I would like Prof. Howe, or anyone else, to explain logically how the assumption of moving magnetic lines causes the magnetic field around an isolated straight conductor to be distributed as it is.

Experimental disproof of Faraday's flux-cutting theory was provided twenty years ago by the failure of a generator designed by Dr. A. E. Clayton and described by him in 1915. In the accompanying sketch of this machine, N is the ring-shaped north pole of the magnet, C, C, C, C are the ends of the straight cores upon which the field coils are wound. A is a ring armature of rectangular cross section, and Y, Y, Y, Y are the ends of the yokes mechanically fixed to this armature and to a similar armature at the south-pole end where the pole piece is of the same shape as N. The armature winding is on the parts between the yokes and (as was verified by Dr. Clayton's measurements) is linked by the same amount of flux in all positions of the armature.



Dr. Clayton's machine

As Dr. Clayton states that no field could be detected on the inner side of the ring, it follows that the machine should have worked in accordance with the flux-cutting theory but not according to the varying linkage theory.

The failure of this machine appears to disprove Prof. Howe's statement that the mere movement of conductors across a magnetic field so as to give a net rate of cutting of lines of force in one direction is sufficient to generate an e.m.f. therein.

The cause of the failure of Clayton's machine is the zero rate of variation of flux linkages with the armature winding. Any argument (including Maxwell's dB/dt theory) put forward to save the flux-cutting theory is self-contradictory, for Clayton's experience disproves the universally taught formula for the force on a conductor of length L cm., carrying I c.g.s. units of current in a magnetic field of flux density B gauss; the formula being Force = BIL dynes.

It follows also that the formula $e = BLv \times 10^{-8}$ volts is also incorrect in general. In this formula B and L have the same meaning as before and v is the velocity of the conductor in cm. per sec.

The failure of Clayton's machine proves that Maxwell, also, is wrong; for in Hague's "Electromagnetic Problems in Electrical Engineering" it is shown that Maxwell's theory of stress in the magnetic medium gives the same result as Ampere's law for the force on a current-carrying conductor in a magnetic field (Force = BIL dynes).

Furthermore, Maxwell's dB/dt theory is derived from Neumann's varying linkage theory, but in expanding and contracting rectangular circuits it contradicts the principle of conservation of energy, although Neumann's law does not. An essentially similar machine to Clayton's was patented in 1887 by F. George. C. Hargreaves.

Bradford, *April 7th*.

Earthing by Water Pipes

Mr. Thom, in a letter given in your issue of March 29th, invites the views of others on certain points relating to earthing by water pipes. It will be generally admitted that an earth connection should be easily capable of carrying a fault current that would readily blow the fuses protecting the circuit. A primary need in this respect is that the earthing resistance of the connection should be sufficiently low in relation to the circuit voltage to permit the required current to pass. To obtain low earthing resistances, it is necessary that the metalwork of the earthing electrode should be in rather extensive contact with the general body of earth.

It appears, therefore, that water pipes used for earthing purposes should be definitely connected to the street (water) mains in order that that extensiveness of contact may be adequately assured. If the water pipes were not so connected, they would probably be in indefinite contact with the general body of earth, as the heating pipes of a house might be, and consequently have a fairly high earthing resistance. In this case there is the possible danger of the pipe system being raised to an appreciable voltage above earth with the liability of shock to persons from any part of the system. The earthing resistance of a pipe is independent of the contents of the pipe.

A particular problem in earthing is one in which a fairly heavy fault current may flow for an appreciable period of time; for example, a fault current of 140 A may flow for several hours through water pipes from a circuit protected by 100-A fuses. In a case of this nature, the capacity of the earth connection to dissipate appreciable amounts of energy without deterioration becomes important. An ordinary small service water pipe carrying current of the order of 100 A would become perceptibly hot in about an hour; the ultimate temperature of the pipe containing still water would hardly exceed 100 deg. C. but that of an empty pipe may be high enough to soften wiped joints, producing permanent damage. P. J. Higgs.

N.P.L., Teddington, *April 5th*.

Picture Gallery Lighting

In your editorial notes on page 478 of your issue of April 5th you make some comments on the National Gallery lighting. When writing them, you were probably not aware that an artificial lighting scheme was carried out about three years ago by this company at the Charlemont House Gallery of the Dublin Corporation, whereby, though a different method was used than that adopted at the National Gallery, similar results were obtained. A striking feature of the Dublin installation was the avoidance of any reflection of the observer in the glazing of the picture.

We have been informed by the curator of the Charlemont House Gallery that the lighting has been inspected by a number of foreign visitors, who have made a particular point of expressing satisfaction with the results obtained and have stated that, to their knowledge, equivalent results had not previously been obtained. Holophane, Ltd.

London, S.W.1, *April 9th*. W. T. Dean.

New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

A Small Table Cooker

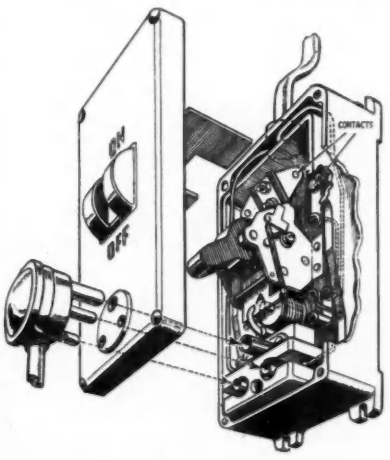
The "Jubilee" cooker of the Revo Electric Co., Ltd., Tipton, Staffs, has been designed primarily for houses and flats with small kitchenettes where a standard cooker cannot be conveniently accommodated, but it is capable of performing most of the operations of a full-size cooker, such as baking, grilling, roasting and boiling. The cooker has a rectangular 2,200-W griller-boiler and an additional 450-W oven heater. The oven is 10 in. wide by 11 in. deep by 10½ in. high, which is sufficient for an 8 lb. joint. Cast-iron is used for the front frame and sheet steel for the sides, back and hob. A removable sheet-metal bottom gives access to the wiring and heating elements, while round the griller-boiler there is asbestos packing to prevent spilt liquids from entering the oven. When boiling only is required a deflector plate is inserted under the element. The interior of the one-piece sheet-steel oven is vitreous-enamelled in blue and, following the standard Revo practice, the rack runners are pressed into the sides. The two 225-W porcelain refractory elements are situated in the base. The lagged sheet-metal door drops down to open, and two separate switches are provided for "on-off" control of the oven element and for the three-heat control of the griller-boiler. Standard equipment includes an oven drip pan and grid and oven rack, the finish being in mottled grey enamel.

The Revo "Jubilee" cooker

Circuit-breaker and Plug Sockets

A combined circuit-breaker and plug socket of unusual design made by A.E.W., Ltd., Imperial Works, High Street, Edgware, consists of a plug and socket, a switch and an electromagnet.

The cable enters the iron-clad case through a conduit hole, from which the neutral wire is taken direct to the plug socket, the "live" wire being led to one side of the switch contacts, which are of the direct-pressure type, and then *via* the electromagnet to the plug socket. In the event of an overload the energised magnet draws down the plate A (see accompanying drawing) which is mechanically connected to the switch contacts, and breaks the circuit. In addition to this safeguard there is a spring interlocking mechanism incorporated in the plug socket so that the switch contacts can only remain closed when the plug is pressed right in. This precludes the possibility of a "flash-over" when the plug is withdrawn and eliminates chance of shock through contact with the pins. Any type of three-pin plug designed to B.S. Specification can be used, and three sizes of circuit-breaker are made, namely, 0.25 to 1 A, 3 to 5 A and 5 to 10 A.



Drawing showing construction of the combined circuit-breaker and plug socket

Coil Winding

An inexpensive model of the "Douglas" power-driven (hand feed) coil winder has been produced by the Automatic Coil Winder & Electrical Equipment Co., Ltd., Winder House, Douglas Street, S.W.1. The machine comprises head- and tail-stocks mounted on an iron base, the spindle being fitted with a loose pulley which is constantly belt driven by a motor on the bench alongside. A special friction clutch, operated by a foot treadle, puts the spindle in and out of action, thus leaving the operator's hands free, and also enabling very gradual starting and stopping of the winding spindle.

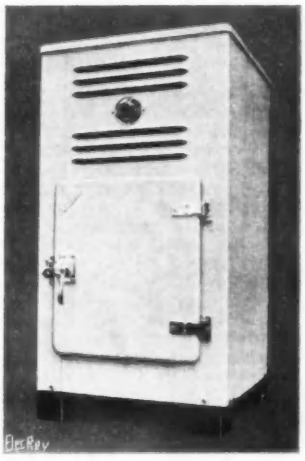
A four-figure revolution counter is provided which can be reset to zero. The loose pulley and the winding spindle are both independently fitted with Hoffmann ball-bearings, and the friction clutch has a ball-bearing thrust. The wire supply reel carrier is mounted on the underside of the bench and will accommodate all sizes of reels up to a width and diameter of 4.75 in. The machine is suitable for winding a very large range of coils up to 6 in. in length and 8 in. in diameter, and wire down to 18 s.w.g. in size can be employed. The motor weighs 24 lb., the winder 20 lb., the treadle 6 lb., and the reel carrier 4 lb.

Air-cooled Refrigerators

The electric refrigerators now being introduced to the British market by Zeros (Sales), Ltd., are to be manufactured at the former Sterling Telephone Works at Dagenham, Essex, by Ismay Zeros, Ltd., an associate concern of John Ismay & Sons, Ltd.

These refrigerators have no motor, they are noiseless, and do not cause radio interference. Operation is on the Normelli principle, of Continental origin, incorporating a generator-absorber, intermediate container, evaporator coil, and a condenser, which is grilled for radiation air cooling so that no water circulation is needed. A control switch enables the degree of coldness to be varied according to the season.

Ordinary household ammonia is gasified by the application of heat three times every twenty-four hours, each cycle being completed in eight hours. The small electric heater element in the generator is switched on automatically for a period of 1.5 hr. during each cycle, to be followed by 6.5 hr. of cooling. Apart from a Venner time switch, there are no moving parts in the machine. For this reason it is claimed that no service after sale is necessary, and a five-year guarantee is given. Four models are available, namely, 2.25 cu. ft., 3 cu. ft. (each with an ice capacity of 1 lb.), 4.25 cu. ft. and 7.25 cu. ft. (each with an ice capacity of 2 lb.). The smallest cabinet can be supplied without legs, in order to facilitate standing on a table, or with short or long legs.



A Zeros refrigerator

A Projector for Horizontal Discharge Lamps

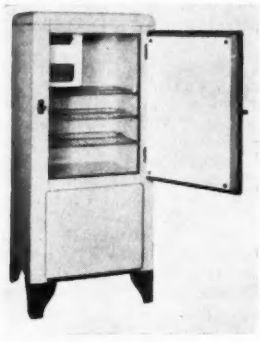
The new type 1261/B floodlighting projector designed for 400-W "Escura" horizontally operated electric-discharge lamps by the Edison Swan Electric Co., Ltd., 155, Charing Cross Road, London, W.C.2, consists of a lighting unit containing the lamp and a magnetic control unit carrying the choke and condenser.

The optical system consists of a combination of specular reflectors and a lens for controlling that portion of the light which would otherwise come outside the cut-off of the reflectors. This equipment is housed in a dust-tight sheet-copper body, having a hinged front glazed with heat-resisting glass. A centring device, which supports the lamp at the end remote from the cap, permits the light column to be coincident with the focal axis both of the reflector and the lens.

The sheet-copper choke box has space for a condenser. Since the magnetic field of the choke is also used to maintain the arc of the lamp centrally, means are provided for fixing the choke in the correct relative position to the lamp.

The Edison Swan horizontal electric-discharge lamp projector

A Domestic Refrigerator



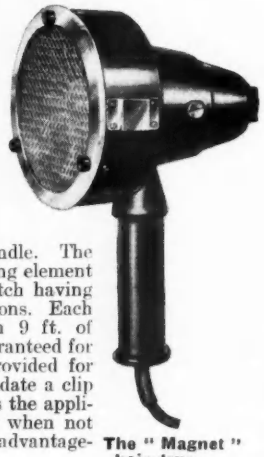
The "Aerofrige"

The "Aerofrige" which has just been placed on the market by British Electric Domestic Appliances, Ltd., 3, Hanover Court, Moor Lane, London, E.C.2, is a type of refrigerator specially suited for use in the home. It is designed on orthodox lines, the compressor, driven by a ¼-h.p. electric motor, being in a compartment underneath the cabinet proper.

The food storage capacity of 5 cu. ft. gives 8¼ sq. ft. of useful shelf area. The exterior finish is white stove-enamel and chromium plate; internally, white vitreous porcelain is used, all corners having a rounded surface to facilitate cleaning. Insulation is by compressed slab cork. Variable thermostatic temperature control to suit all conditions is provided, and there are two ice trays, which have together a capacity of 42 cubes.

An Improved Hair-dryer

The diffuser-type hair-dryer recently added to the range of household appliances manufactured by the General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2, has an exceptionally large diameter outlet for the emission of a more substantial volume of air, and this, combined with a larger heater, results in very rapid drying. The black anodised aluminium casing makes the dryer light and easy to handle. The motor is well built, and the heating element is controlled by a three-way switch having "hot," "cold" and "off" positions. Each dryer is supplied complete with 9 ft. of 3-core "Domestaflex" and is guaranteed for twelve months. A bracket is provided for screwing to the wall to accommodate a clip on the dryer casing which enables the appliance to be hung out of the way when not in use. This dryer is especially advantageous for hair setting.



The "Magnet" hair-dryer

Reflectors for "Philora" Lamps

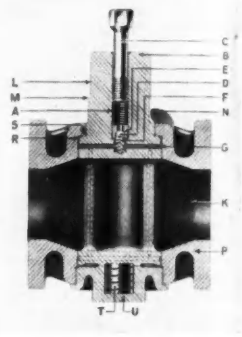
A wide range of "Solux" street-lighting units designed specially for Philips "Philora" electric discharge lamps has been introduced by the Wardle Engineering Co., Ltd., Old Trafford, Manchester, 16. The range includes refractor lanterns and directional units for vertically mounted lamps and asymmetric and directional units for horizontally mounted lamps. The refractor lanterns comprise a cast-iron cowl, spun copper body and a cast-iron hinged globe supporting ring, all the necessary gear with the exception of the power-factor condenser being housed in the lantern. Four shapes of directional unit are obtainable for the vertical type, and in all cases the diffusing mirrors are cemented into a cast-iron body, a feature also applying to the horizontal asymmetric units which are obtainable with vertical pillar brackets to which is fixed the box containing the necessary electrical gear and fuses. The "Solux" horizontal directional unit comprises a galvanised sheet top fixed to galvanised cast end plates to which are secured the reflecting plates.

The lamps for these units are the Philips "Philora" sodium electric-discharge class which are now obtainable in as small a size as 50 W.

A Lubricated Plug Valve

The construction of the Newman-Milliken plug valve is based on the principle of protecting all points where leaks can occur with viscous lubricants under a pressure at least equal to the pressure of the liquid controlled by the valve. A positive ball check, actuated by a spring, maintains the lubricant pressure constant and prevents the liquid from finding its way between plug and body. A horizontal lubricant duct seals the vertical joint between the plug and body.

The head of the valve is cast integral with the body thus obviating the need for a packing gland, and there are no seats that can be cut by foreign matter. The plug, being of the parallel type, cannot be forced on to its seat by taking up gland bolts and so keeps its original fit. The standard valve opens and closes with a quarter turn. Messrs. Newman, Hender & Co., Ltd., Woodchester, Glos., are now manufacturing the valve in Great Britain.



The Newman-Millikin valve
A, lubricant receptacle; B, plug; C, lubricant screw; D, ball check; E, ball check seat; F, ball check spring; G, upper horizontal lubricant duct; K, port; L, plug stem; M, plug stop; N, body stop; P, valve body; R, plug shoulder; S, body shoulder; T, plug support spring; and U, bottom cover.

Electricity Supply in Dolgelley

THE Urban District Council of Dolgelley, Merionethshire, having failed to negotiate a bulk supply from the North Wales Power Co., received the consent of the Electricity Commissioners to the establishment of its own generating station. The authority called in Mr. W. M. Harris, A.M.I.E.E., of Messrs. Gilbert Gilkes & Gordon, Ltd., who, assisted by Mr. Parry Jones, the local resident engineer, prepared a hydro-electric scheme, generally on similar lines to the installation carried out by this firm for the neighbouring town of Machynlleth.

The Dolgelley power station

It was decided to make use of the River Aran, which rises in the small lake Llyn Aran, on the north slopes of Cader Idris and thence falls rapidly into the valley in which the town is situated. The plant consists of two Gilkes "Turgo" impulse turbines with shaft governors, one of 80 and one of 40 h.p., each coupled to a Brush 400-V three-phase alternator. As a stand-by against water shortage a 100-h.p. Brush Diesel horizontal engine, driving a 66-kW alternator by V ropes is also provided, with space for a second set. A three-panel switchboard controls the output of each generator, and a transformer steps up the voltage from 400 to 3,000 V for transmission to the sub-station in the town below—about 1,000 yards. Over-compounding of the alternators by the use of current transformers and rectified excitation has been adopted for the water power units which, combined with the sensitive governors, enables the station to run practically unattended. The power house consists of an old woollen mill, picturesquely situated in a secluded wooded valley, about 500 ft. above the town.

Transmission for half the distance to the town is overhead. In the centrally situated sub-station are a h.v. circuit-breaker, a 3,000/400-V step-down transformer, and an l.v. distribution board. The distribution system, which has been carried out by Callender's Cable & Construction Co., under the control of their north-west district manager, Mr. L. H. Larcombe, consists of multi-core armoured cables laid direct in the ground over the central portions of the town, and overhead lines in the outskirts.

A complete system of street lighting has also been carried out by Callender's, using reinforced concrete lamp standards where required, and controlled by a switch situated in the sub-station.

Already a large proportion of the houses have been connected and it is anticipated that it will not be long before the whole town goes over to electricity. An assisted wiring scheme has been largely instrumental in bringing about this state of affairs. The supply was inaugurated on April 3rd, the local Parliamentary representative, Mr. Haydn Jones, performing the ceremony in the presence of a large company representative of all the chief interests of the town and county.

Germany's Electrical Exports

A continued decline

THE official returns of Germany's foreign trade during 1934 show that the decline in electrical exports which had been noticeable for five years was continued. Electrical machinery exported last year amounted in weight to 115,370 double centner, one double centner = 220.5 lb., compared with 131,325 double centner in 1933, 382,750 in 1930, and 356,616 in 1929. Other electrical goods exported last year amounted to 512,657 double centner, compared with 540,545 double centner in 1933, 1,235,200 in 1930, and 1,280,458 in 1929. The values were:—Machinery: 1934, 30,215,000 Rm.; 1933, 35,188,000 Rm.; 1929, 97,751,000 Rm. Other electrical goods: 1934, 168,832,000 Rm.; 1933, 185,260,000 Rm.; 1929, 481,481,000 Rm. It should, however, be noted that reparation deliveries in 1929 were substantial, totalling in value over 33,000,000 Rm. for the two groups. Such deliveries ceased in July, 1932.

Imports of electrical material of all kinds during 1934 were well below the 1930 level, although imports of goods other than machinery rose in value to 21,982,000 Rm. from 20,443,000 Rm. in 1933. The 1930 figure was, however, 34,430,000 Rm. Imports of electrical machinery fell to 3,824,000 Rm., from 4,760,000 Rm. in 1933 and 9,200,000 Rm. in 1930. The totals mentioned do not include a certain amount of electrical material which is classified under other headings in the official figures.

The following statistics show the values in thousands of marks, weight in double centner, and in some instances the number of pieces of electrical machinery and apparatus exported from Germany during 1934, together with the values to the principal countries of destination (apart from the Saar) of the more important groups of articles. The increases or decreases compared with 1933 are also given. Outstanding destinations for the dynamo, motor, &c., group were:—Up to 5 double centner: Holland, Austria, Argentina, India and China. From 5 to 30 double centner: France, Argentina, Soviet Russia and Spain; and over 30 double centner: Soviet Union, France and Italy.

	1934.	Inc. or dec. compared with 1933.
Lighting and starting apparatus for motor vehicles—		
Value	4,070	+ 370
Weight	7,180	+ 1,190
Number	82,230	+ 19,700
Dynamos, motors, convertors and transformers, up to 5 double centner—		
Value	14,173	+ 393
Number	1,112,625	+ 298,525
Weight	45,233	+ 5,723
Dynamos, motors, convertors and transformers, from 5 to 30 double centner—		
Value	3,810	— 1,653
Number	1,955	— 105
Weight	20,805	— 3,995
Dynamos, motors, convertors and transformers, over 30 double centner—		
Value	5,530	— 3,420
Number	330	— 90
Weight	34,900	— 16,200
Armatures and commutators—		
Value	2,620	— 680
Weight	7,210	— 2,740
Cable—		
Value	10,800	— 1,700
Weight	184,100	— 5,900
Holland	1,890	— 970
Sweden	820	+ 130
Argentina	2,400	— 270
Uruguay	580	— 890
Accumulators, plates, etc.—		
Value	2,420	— 980
Weight	25,130	— 8,870
Holland	710	— 490
Finland	100	— 40
Argentina	160	+ 30
Brazil	79	— 61
Sweden	170	+ 40
Denmark	88	— 117
Electric irons—		
Value	600	— 110
Heating and cooking apparatus—		
Value	6,610	— 210
Galvanic batteries and parts, and heating elements—		
Value	1,930	— 570
Weight	15,800	— 2,700

	1934.	Inc. or dec. compared with 1933.
Measuring and recording instruments—		
Value	17,880	— 1,870
Weight	14,410	— 1,500
Soviet Union	1,220	— 2,140
Belgium	940	+ 20
Holland	2,390	+ 520
France	700	— 250
Great Britain	1,510	+ 10
Sweden	1,260	— 90
Argentina	330	— 910
Spain	990	— 70
Italy	1,130	+ 80
China	620	+ 220
Metal filament lamps—		
Value	9,450	— 1,250
Millions	41.0	— 2.2
France	1,000	— 510
Denmark	630	— 140
Norway	490	— 140
Italy	650	+ 80
Switzerland	620	— 90
Argentina	600	— 300
Telephone material—		
Value	12,000	— 1,060
Weight	7,680	— 1,100
France	500	— 340
Italy	2,050	+ 540
Holland	3,670	+ 1,270
Uruguay	880	— 980
Wireless material—		
Value	26,940	+ 2,460
Weight	35,260	+ 910
Belgium	1,590	— 2,040
France	2,700	— 250
Italy	740	— 660
Holland	5,320	+ 750
Sweden	1,740	— 430
Switzerland	1,640	— 1,560
Czechoslovakia	1,330	— 310
Argentina	1,180	+ 520
Safety and signalling apparatus—		
Value	3,500	— 490
Weight (double centner)	6,610	— 190
Great Britain	360	— 76
Italy	250	— 220
Switzerland	300	— 10
Holland	560	— 100
Japan	220	+ 110

	1934.	Inc. or dec. compared with 1933.
Ignition apparatus, etc., and parts (excl. magnetos) and elec. accessories for motor vehicles—		
Value	10,180	— 790
Weight	12,080	— 2,110
Belgium	430	— 330
France	1,080	— 870
Italy	2,050	+ 910
Sweden	810	+ 250
Japan	540	— 180
Great Britain	910	— 40
United States	600	— 100
Apparatus for lighting, power transmission, electrolysis, resistances, etc.—		
Value	51,050	— 4,620
Weight	149,200	— 10,100
Belgium	3,600	— 70
Denmark	1,720	+ 120
France	5,000	— 1,200
Italy	2,600	— 300
Holland	6,900	— 1,760
Sweden	5,500	+ 970
Argentina	1,600	+ 50
Great Britain	2,300	— 320
Telegraph or telephone insulators—		
Value	1,900	— 30
Weight	21,800	— 900
Electro-medical and dental apparatus—		
Value	8,800	— 300
Carbon and brushes, microcarbons, etc.—		
Value	1,330	— 170
Weight	710	— 105
Arc lamps carbons—		
Value	1,370	— 450
Weight	3,750	— 1,400
Electrodes—		
Value	7,110	— 490
Weight	152,000	— 3,000
Conduit tubes of paper or cardboard—		
Value	1,130	— 140
Weight	23,400	+ 4,170

Registered Electrical Contractors

IN our issue of March 29th we reviewed the 1934 report of the National Register of Electrical Installation Contractors. This was presented at the annual meeting on April 5th, when Mr. P. V. Hunter, chairman, presided. Mr. W. R. Rawlings (hon. treasurer) briefly touched upon the principal items in the accounts, stressing the fact that the present income from renewal fees would not meet the annual expenditure as increased by the cost of a second inspector. He held the view that registration fees from new entrants should be capitalised.

The motion for the adoption of the report and accounts was seconded by Mr. H. J. Cash and carried, and subsequently the retiring members of the Board and Executive Committee were re-elected. Mr. P. V. Hunter and Mr. A. H. Dykes were re-elected chairman and vice-chairman respectively.

The meeting then considered the following resolution from the Executive Committee: "That the National Register are of opinion that all electrical installation work should only be carried out by properly registered operatives, and that this Executive Committee be authorised to convene a conference to see what steps can be taken to secure this end." There was a note in the agenda to the effect that under its existing constitution the National Register has no power to act as such a registering body and it would therefore be necessary to set up a separate organisation for the purpose.

Mr. H. J. Cash said that while he was of the opinion that the registration of operatives was most desirable, he was doubtful whether the Register was the right body to convene such a conference as was suggested. He took it that the resolution was more or less the expression of a point of view. He understood that the E.T.U. was favourable to the idea of registration, and the I.M.E.A. and E.C.A. were also moving in this direction.

Mr. W. R. Rawlings also expressed doubt as to the suitability of the Register's calling such a conference. Mr. W. Calvert said that whatever body undertook the convening of the conference its motives would be liable to misconstruction.

Mr. Cash suggested that the I.E.E. should be asked to call the conference, and this appeared to meet with the approval of the meeting. Finally the resolution was amended to read "This Executive Committee be authorised to convene or arrange for the convening of a conference," and was then carried.

Mr. Hunter referred to the death of the Register's solicitor, Mr. T. Trimnell, and said that his successor, Mr. Wright, had found some points in the by-laws which required amendment. The matter was being considered by the Executive Committee and would be placed before a special general meeting to be convened later.

Votes of thanks were accorded the chairman, the Executive Committee, and the staff, and the sum of ten guineas was voted to the I.E.E. Benevolent Fund.

Parliamentary News (BY OUR SPECIAL REPORTER)

On April 3rd Mr. West asked the Minister of Transport whether his attention had been drawn to the proposed merger of capital and administration of certain electricity companies operating in the west of London; and whether he was satisfied that the proposal was not detrimental to the interests of the consumers of electricity and did not infringe any of the provisions of the London Electricity (No. 2) Act, 1925.

Mr. Hore-Belisha said he was not aware of any infringement of the provisions of the Act referred to; the results to the consumers would depend on the efficiency of the future management as compared with that of the separate companies.

Mr. West further asked the Minister of Transport whether he would take steps to ascertain the views of the London County Council and the London and Home Counties Joint Electricity Authority on the proposed merger, having regard to the provisions of the London Electricity (No. 2) Act, 1925, under which these undertakings were to be transferred in 1971 to the Authority and to the control which, in certain circumstances, the London County Council and the Joint Electricity Authority had over the operations of these companies.

Mr. Hore-Belisha said that if the London County Council or the London Joint Electricity Authority found it necessary to make any representations on any matters which were within his jurisdiction he would be glad to consider them.

Supply Capital and Dividends

On April 3rd Mr. West asked the Minister of Transport what were the values on January 1st, 1934, as respected municipal electricity undertakings, of the total outstanding loan capital, average interest rate, and average loan period, and for the same date, as respected company undertakings, of the loan capital (mortgage debentures, &c.), preference capital, and ordinary capital, and the average dividend rate in each of the years from 1929 to 1934.

Mr. Hore-Belisha said that the latest returns showed that at March 31st, 1933, the outstanding loans of municipal electricity undertakings (including electricity undertakings of joint boards and joint electricity authorities) amounted to £144,150,000. The amount paid in interest by these undertakers in 1932-33 was £6,844,000, being an average rate of 4¾ per cent. on the loans outstanding. Sinking fund and loan repayment in 1932-1933 required £7,826,000. The average loan period could not be stated.

As regarded companies the returns for the year 1932 showed issued capital as follows:—Loans, (debentures, &c.), £47,417,062; preference shares, £21,168,423; ordinary shares, £63,412,087; total, £131,997,572. The average rates of dividend paid (per cent.) were as follows:—1929, pref. 5.87, ord. 7.02; 1930, pref. 5.79, ord. 6.85; 1931, pref. 5.78, ord. 7.05; 1932, pref. 5.71, ord. 6.73. Figures for the past two years had not yet been compiled.

Supply Undertakings' Rates

On April 3rd Mr. D. Grenfell asked the Minister of Transport what were the total rates paid for the years 1923 and 1933 by all authorised electricity supply undertakings, and what those sums represented per kilowatt of connected load and per kilowatt of installed generating plant capacity; what these values were for municipal authorities and company authorities, respectively; and what the lowest and the highest rates per kilowatt of connected load and per kilowatt of installed generating plant capacity were for the years 1923 and 1933.

Mr. Hore-Belisha said that the figures were as shown in the following table:—

Particulars.	All undertakings.	Public authority undertakings.	Company undertakings.
	£	£	£
Total rates paid during 1924–25	1,790,746	1,189,178	601,568
" " " " 1932–33	4,453,065	2,749,070	1,703,995
	s. d.	s. d.	s. d.
Average rates per kW. of connected load, including bulk supplies, 1924–25*	5 6	5 6	5 7
Do. 1932–33*	5 7	5 3	6 3
Average rates per kW. of installed generating plant capacity, 1924–25	9 7	9 5	10 1
Do. 1932–33	12 1	11 8	12 10

* As the ratio of bulk supplies to total supplies varies, the figures for the two periods are not strictly comparable.

In the Courts

In the Chancery Division on April 5th Mr. Justice Farwell had before him a motion by the Westinghouse Brake & Signal Co., Ltd., in an action for alleged passing-off against the Varsity Eliminator Co., Ltd.

Mr. Kenneth Swann, for the plaintiffs, said the defendants, he thought, had not put in an appearance to contest the motion. The action concerned alleged passing-off of an unusual character and an injunction until the trial of the action was asked for. The plaintiffs manufactured rectifiers for wireless apparatus. They alleged that these rectifiers had been taken to pieces, put together again in a mutilated form so that twelve units were made out of ten rectifiers. These, it was asserted, were sold by the defendant company as Westinghouse rectifiers.

Mr. Swann read affidavits made by Mr. B. H. Peter and Mr. L. H. Peter stating that the action of the defendants in selling the mutilated rectifiers as those of the plaintiffs was calculated to do the company harm and was an imposture on the public.

His Lordship granted an injunction in the terms of the notice of motion until the trial of the action, or further order, the costs to be costs in the action.

The Highfield Electrical Co., Ltd.

In the Companies' Court on Monday last Mr. Justice Bennett had before him in the list for hearing a creditors' petition for a winding-up order against the Highfield Electrical Co., Ltd., but it was ordered to stand over for a week until April 15th.

It was stated by counsel that the petitioners were judgment creditors for £1,000 against the company, and there were negotiations for a settlement to be arrived at.

New Books

"Engineering Economics: Works Organisation and Management," by T. H. Burnham, B.Sc. Hons. (London), &c. (Pp. 32+280). London: Sir Isaac Pitman & Sons, Ltd. Price 8s. 6d. net. This is the first part of the third edition of a work originally published in 1929. It has been extensively revised and added to, and a logical division into two parts has been made. This part covers economic influences and factors, dealing with such subjects as the elements of economics, industrial history, the commercial system, business organisation, charts and statistics, commercial law and kindred matters. The second part, to be published shortly, will deal with the practical applications of the ideas presented in the book now issued.

The student of radio engineering who has to memorise a large number of definitions, processes, formulæ and circuits will find much to assist him in "Definitions and Formulæ for Students of Radio Engineering" which has recently been published by Sir Isaac Pitman & Sons, Ltd., 6d.

"Marketing Industrial Equipment," by B. Lester. (307 pp.) London: McGraw-Hill Publishing Co., Ltd. Price 21s. net. The author of this book is a member of the sales staff of the Westinghouse Electric & Manufacturing Co., Pittsburgh, which gives the book an electrical (and American) bias. After a preliminary survey of the development of industry, the book deals with the character and extent of the industrial market, and the production machinery and equipment required by industry. Then in subsequent chapters the author explains in some detail market research, sales expenses, methods of organising selling departments, sales promotion and kindred subjects. The bibliography at the end of the book shows that the author's research has been most extensive.

The success of the first edition of "Factory Administration in Practice" (Hiscox, 1921) has made a second edition necessary (Sir Isaac Pitman & Sons, 8s. 6d.), and the author, Mr. J. R. Price, has taken the opportunity to make minor revisions in the text in the light of the developments of modern practice, as well as to increase the scope of the book. This has been found necessary owing to the large demand for a practical rather than a theoretical book, and the writer has included additional matter on factory buildings, plant and materials.

In the 1935 "British Plastics Year Book" (Plastics Press, 15s.) two articles are included on cast resins in the two countries which have progressed farthest with them, *i.e.*, Germany and America, while particulars are also given of a new application of resins as water softeners and for similar uses. The usual directories are included, and there are 718 pages.

We have received a copy of the 1935 edition of "Laundries and Laundry Requisites" (Shepherd & Hosking, 4s. 6d.). It is divided into two main sections, a buyer's guide and a directory of laundries under county headings.

"Principles of Electric Power Transmission by Alternating Currents," by H. Waddicor. (Third edition.) Pp. 489; figs. 164. London: Chapman & Hall, Ltd. Price 21s. net.

"Electric Wiring" (Fourth edition), by W. S. Ibbetson. Pp. 253; figs. 132. London: E. & F. N. Spon, Ltd. Price 6s.

Business and Industrial Notes

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments. Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures

British Industries Fair

Since publishing in the ELECTRICAL REVIEW of February 8th names of firms exhibiting at the Birmingham Section of the British Industries Fair we have received a more up-to-date list of exhibitors from which we have extracted the following additional names:—

Beetle Products Co., Ltd.
Broughton, J.
Bylock Electric, Ltd.
Cambridge Instrument Co., Ltd.
Engineering Products and D. Hollander, Ltd.
Fitz-Gibbon & Murray, Ltd.
Foster Instrument Co.
Haslam & Newton, Ltd.
Henderson, T., & Son, Ltd.
Henderson's Wholesale Electric & Radio, Ltd.
Ioco Rubber & Water-proofing Co., Ltd.
Heyes & Co., Ltd.
Lucas, Joseph, Ltd.
Marks, S. (A.B. Metal Products)
Mek-Elek Engineering Co., Ltd.
Rawson, H. C. (Sheffield & London), Ltd.
Rudd, E., & Co., Ltd.
Shaw, J., & Sons (Salford)
Sheffield Smelting Co., Ltd.
Syntho Marble Co.
Tok Switches, Ltd.
Walker Fender Co., Ltd.
Webb's Crystal Glass Co.

Wages in the Electrical Industry

The director and secretary of the National Federated Electrical Association informs us that the present rate of wages in the electrical contracting industry, which was fixed for the six months ending on the first pay-day in April, is to remain in force until further notice. Negotiations between the Association and the Electrical Trades Union are still proceeding.

We are also informed by the chairman of the Joint Industrial Council for the Electrical Cable Making Industry that the present rates of pay for plumber-jointers and their mates are to remain in force until further notice.

The "Lewcos" Arts and Crafts Exhibition

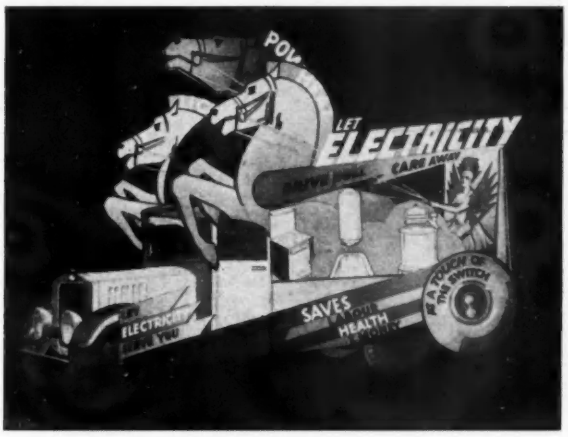
The Arts and Crafts Section of the "Lewcos" Social and Athletic Club held its second annual exhibition at the Works, Church Road, Leyton, on March 30th. The display, which was opened by Mr. E. Leete (managing director), showed an advance both in the number and quality of the exhibits. The recently redecorated hall was arranged in a series of bays which showed the many classes off to the greatest advantage, while the stage was devoted to a display of carpentry and cabinet work. Nearly 100 photographs, many of outstanding merit, were shown, together with a very representative array of the graphic arts including paintings in oils and water-colour, crayon drawings, pen and ink sketches, and black and white drawings. Though small, the section devoted to models of all kinds was interesting, and a group of competitive posters advertising the exhibition attracted considerable attention. The ladies of the staff contributed a display of knitted garments, crochet, embroidery and similar work, while the cake-making classes were popular. There were also sections devoted to the display of flowers, oriental craftsmanship and geological collections. A picture appears on page 528.

A Large Condenser for Japan

In the accompanying illustration we show two halves of a condenser for the Kansai Power Co., Japan, ready to start from the Trafford Park works of the Metropolitan-Vickers Electrical Co., Ltd., on their journey by road to Birkenhead Docks, for direct shipment to Japan. The width of the load was a little under 18 ft. and it necessitated a night journey and a special police escort throughout. The condenser is of the "Met-Vick" central-flow type, having 58,500 sq. ft. of cooling surface, and is of welded construction. It is for use in connection with a 53,000-kW "Met-Vick" turbo-alternator set for the Kansai Co.

The E.D.A. May Programme

The May programme of the British Electrical Development Association is almost entirely devoted to opportunities which the forthcoming Jubilee celebrations offer the electrical industry of demonstrating the important part which it plays in the life of the nation and contains suggestions for carnivals, decorations, window displays, literature and advertising. For carnivals the Association has designed a striking processional car, shown in the accompanying illustration, the attractiveness of



The E.D.A. Jubilee Processional Car

which is enhanced by the movement of the horses, which "prance" as the vehicle moves along. The Jubilee window display was illustrated in our March 29th issue, page 452. A souvenir of the Royal Jubilee, in the form of a review of twenty-five years' progress, has been produced, which the Association recommends for distribution in schools. A flexible gramophone record of "Plenty of Time for Play" is now available.

A Refrigerator Dealers' Conference

On March 28th the first annual "Westinghouse" refrigerator dealers' conference was held in the conference room at Bush House, the head offices of the Lightfoot Refrigeration Co., Ltd., sole distributors of "Westinghouse" refrigerators for Great Britain and Ireland. Mr. K. Lightfoot (managing director) presided, and after welcoming those present dealt with the various ramifications of the Lightfoot Co. since his father first established the business over fifty years ago, until it became associated with the distribution of Westinghouse refrigerators three years ago. This was followed by addresses by Mr. Baker, European manager of the Westinghouse International Co., and Mr. Lissenden, of that company's London office. Mr. V. A. Mattick, manager of the Westinghouse Department of the Lightfoot Refrigerator Co., Ltd., then introduced the new 1935 series of streamline models. After the luncheon interval

Two halves of a large "Met-Vick" condenser leaving the company's works for shipment to Japan

the conference continued and several sound films were shown depicting the manufacture and special features of the new models. This was followed by an address by Mr. Maclean, sales promotion manager of the Westinghouse Department of the Lightfoot Co. After the conference the company was entertained at a banquet at Frascati's, Mr. K. Lightfoot presiding.

New B.I. Glasgow Showroom

British Insulated Cables, Ltd., has now opened a showroom at 17/19, Wellington Street, Glasgow, C.2. The display includes examples of all the principal products of the company. Cables are represented by showcases containing sectional samples of all types of cable, while boxes include examples of l.v. distribution boxes, super-pressure terminal boxes, service boxes and cut-outs. Among the cable exhibits is a collection of

Resistance welders in the new B.I. Glasgow showroom

some of the earliest cables made by the company. A complete distribution pillar and a pillar unit of the latest type are also included. A full range of electricity meters is shown, together with flexibles, wires, metals, &c. Part of the showroom has been set apart for the purpose of demonstrating resistance welding, and our picture shows the machines installed which include one of the latest power-driven continuous-spot welders, as used for mass-production work. Two of the windows have effective displays showing cables and trolley bus line fittings respectively.

Vacuum Cleaner Developments

We are asked by Messrs. John Ismay and H. C. Rawson to state that they have resigned from the board of British Electric Domestic Appliances, Ltd., proprietors of the "Mary Ann" vacuum cleaners, and are joining the board of Electrix, Ltd., manufacturers of the "Electrix" vacuum cleaners. The latter cleaners will be manufactured at Sterling Works, Dagenham.

British Electric Domestic Appliances, Ltd., inform us that Mr. S. F. Sheridan has purchased the shares held by Messrs. Ismay and Rawson; also that Mr. Charles W. Hill has been elected a director, and Mr. Sheridan has been appointed managing director. Mr. E. O. Pollak is sales manager and Mr. G. M. Haynes secretary of the company.

The Ontario Power Contracts

A Bill has been introduced by Mr. F. Hepburn, Premier of Ontaria, declaring contracts for electric power between the Ontario Hydro-Electric Commission and the Beauharnois Power Corporation, the Maclaren-Quebec Power Co., and the Chats Falls Power Co. to be "illegal, void, and unenforceable." The Premier further states that the Hydro-Electric Commission would buy what power was necessary from the Gatineau Power Co. The *Financial Times* states that it is understood that a clause has been inserted in the Bill prohibiting the companies concerned from appealing to the Courts with a view to testing the legality or otherwise of their contracts. When the slump set in in 1929 the demand for power fell away, and at present the Hydro-Electric Commission, it is stated, finds itself in the position of having arranged for more power than it requires.

Manchester Contractors' Dinner

About 100 Manchester and district electrical contractors and guests drawn from the various sections of the electrical industry attended the dinner of the Manchester Branch of the Electrical Contractors' Association at the Midland Hotel, Manchester, on April 4th. Mr. L. E. Wilson, A.M.I.E.E., who presided, said that success in the electrical business required direct and sympathetic contact with the public and the wholehearted support of the supply authorities. As a result of the activities of the branch he hoped there would be a national code for the electrical industry, a code which would be accepted in law to secure reasonable protection for the public arising from the misuse of electricity and also the establishment of a proving house. Amongst the questions before the industry were the desirability of a pension scheme, self-government of the industry, and apprentices.

Mr. R. Harrison Watson referred to the Manchester movement to stop the manufacture and sale of apparatus which was unsafe for public use. He was sure the manufacturer, supplier and distributor would deplore any attempt to turn out apparatus "down to a price" if the appliances were unsafe to use. Mr. E. G. Batt, chairman of the Heating, Cooking and Domestic Appliances Section of B.E.A.M.A., said that one could view the future of the electrical industry with optimism. One of the pleasant things was the increase in the export trade, particularly to the Dominions. After a reference to the B.S.I., Mr. Batt said attention had been given to unsafe electric fires. The I.M.E.A. had recognised the seriousness of the situation and had addressed a letter to the leading chain stores of the country acquainting them with the dangers of distributing unsafe apparatus. He announced that fifty or sixty of the leading manufacturers of appliances had unanimously decided that from September 1st they would supply only three-core flex instead of two-core with their domestic appliances unless orders to the contrary were received.

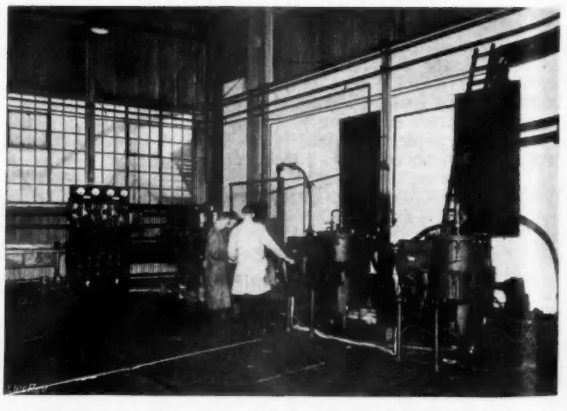
Mr. H. C. Lamb, chief engineer and manager of Manchester Electricity Department, said he desired the co-operation of the electrical contractors, but, as a municipal body, they must have a strong association to co-operate with. He claimed that his department was a good unpaid partner in the contractors' business—it made inspections of jobs and did not charge for its services, but unfortunately, some contractors did not view the matter in that light. Again, some contractors did not like the Corporation's hire-purchase schemes, but if easy-payment terms were not arranged the apparatus would not be used to the same extent.

The Copper Agreement

Under the agreement reached by the conference of copper producers recently held in New York, production of primary copper outside the United States will be reduced by 20 per cent. as from May 1st next, and by 30 per cent. as from June 1st. According to the *Times*, these reductions, which were determined by mutual agreement on the basis of the curtailment considered necessary to bring non-American production and United States exports into line with non-American consumption, are applicable to the so-called basic tonnages which have been fixed for each producer. Producers in Canada and Peru are not participating in the curtailment scheme, but they have agreed to refrain from increasing their production to an unreasonable extent. All questions concerning the reduction of output will be dealt with by a permanent committee established in Europe, comprising representatives of each of five important American, Rhodesian, and Belgian companies. The agreement has been made for a trial period of one year to end in May, 1936.

Low-voltage Electrode Water-heaters

The accompanying illustration shows electrical thermal-storage plant for the Belfast Union Maternity Hospital on test in the works of Messrs. A. Reyrolle & Co., Ltd., at Hebburn-on-Tyne. It comprises two 200-kW 400-V electrode-heaters arranged for complete automatic operation, two 400-A motor-operated horizontal draw-out pillar-type metal-clad circuit-breakers, and a polished slate panel carrying the indicating load-controlling and protective instruments. Similar Reyrolle plant is at present being installed at the new Shirehampton Baths of the Bristol Baths Department for heating both the building and the bath-water. For this



Thermal-storage plant on test at Messrs. A. Reyrolle's works

purpose there are two heaters, each with a maximum rating of 400 kW. These are used, with automatic control, up to their full rating for heating the building, but the control is so arranged that when either or both of them are used for heating bath-water a relay is automatically introduced to limit the possible range of load to a maximum of 120 kW on either heater, still with complete automatic control up to the new maximum. Discriminative earth-leakage protection is always provided as a standard, in addition to ordinary protective apparatus. This ensures maximum stability under any external-fault condition.

The West Hartlepool Exhibition

An electrical exhibition arranged by the West Hartlepool Corporation in the Masonic Hall, and directed by Mr. S. Tillotson,

the electrical engineer, was held last week, and some thousands of people visited the show. Conspicuous features were model dining rooms, bedrooms and bathrooms, electrically fitted; while the model kitchen included cookers, refrigerators, cleaners, and so on. The Corporation Electricity Department had a large stand showing all kinds of equipment, and cooking demonstrations were given. A number of electrical firms stands had representative displays. The E.D.A. talking films were shown to eighteen audiences totalling 2,500.

Engineers' Wages Increase

As the result of a conference between committees appointed by the Engineering Employers' Federation and the engineering trade unions held in London on April 4th it was decided to recommend that adult male workers in the engineering industry should receive an increase in wages of 2s. per week in two equal instalments, the first payable from May 13th, and the second from July 15th.

Trade Announcements

Mr. J. B. Rudkin, A.M.I.E.E., who as stated in our issue of March 8th recently disposed of his financial interest in Standard Switchgear, Ltd., is now carrying on business as a manufacturer of electrical apparatus under the style of J. B. Rudkin & Co., Ltd., at 59/61, New Oxford Street, London, W.C.1. His company will specialise in switchgear for outdoor and indoor service on h.v. and l.v. distribution systems.

Messrs. Spicers, Ltd., inform us that owing to the death of Mr. F. J. Donnelly, their Lancashire, Yorkshire and Cheshire representative, they have appointed Messrs. A. W. Taylor & Co., 5, New Brown Street, Manchester, 4, as their representatives in these areas.

The Ray Engineering Co., Ltd., has opened an office at 53, Queen Square, Bristol, 1, and is representing, in addition to its own works, Messrs. E. N. Bray, Ltd., Wm. Sanders & Co. (Wednesbury), Ltd., and the Metropolitan Electric Cable & Construction Co., Ltd.

A Request from Mauritius

Mr. Amo de Abdool Carrim, Commission Agent, P.O. Box No. 124, Port Louis, Mauritius, wishes to get into touch with manufacturers and exporters of electrical goods, and he asks for catalogues and prices.

Prices of Materials

The following prices are only general, and they may vary according to quantities and other circumstances.

CHEMICALS, ETC.	Price, April 10th.	Fortnight's Inc. or Dec.
a Acid, Oxalic ... per cwt.	50s.	—
a Ammoniac, Sal ... per ton	£40	—
a Ammonia, Muriate (large crystal) ... ,,	£38	—
a Borax ... ,,	£17	—
a Copper, Sulphate ... ,,	£19 15s.	—
a Potash, Chlorate ... per lb.	3¾d. to 4¼d.	—
a ,, Perchlorate ... ,,	6d.	—
a Shellac T.N. ... per cwt.	£4 18s.	—
a Sulphur Commercial... per ton	£11	—
a ,, Roll ... ,,	£11	—
a Soda Chlorate ... per lb.	3¼d. to 3¾d.	—
a ,, Crystals... ... per ton	£5 to £5 5s.	—
a Sodium Bichromate, casks ... per lb.	4d. nett.	—
METALS, ETC.		
b Aluminium, Ingots ... per ton	£100 to £105	—
b ,, Wire ... per lb.	1/1 to 1/9	—
b ,, Sheet and Foil... ,,	1/2 to 2/9	—
b Babbits Metal and Anti-friction Metals—		
Grade I ... per ton net	£206	£10 inc.
Grade II ... ,,	£141	£6 inc.
Grade III ... ,,	£73	£3 inc.
c Brass (rolled metal 2" to 12" basis)... per lb.	7d.	¼d. inc.
c ,, Tubes (solid drawn) ... ,,	9d. to 9½d.	¼d. inc.
c ,, Wire, basis ... ,,	7⅞d.	¼d. inc.
c Copper Tubes (solid drawn)... ,,	9¼d.	¼d. inc.
d ,, Bars (best selected)... per ton	£60	£2 inc.
d ,, Sheet... ,,		
d ,, Rod ... ,,		
d ,, (Electrolytic) Bars ... ,,	£35 15s.	£3 10s. inc.
d ,, ,, Wire Rods ... ,,	£40	£3 10s. inc.
d ,, ,, H.C. Wire ... per lb.	6¾d.	¼d. inc.
Ebonite Rod ... ,,	1/6 to 2/– plus	—
,, Sheet ... ,,	1/3 to 1/6 / 10%	—
a German Silver Wire ... ,,	2/5	—
b Gutta-percha, fine ... ,,	nom.	—
b India-rubber, Para-fine ... ,,	4¾d.	—
i Iron, Pig (Cleveland No. 3)... per ton	62/6	—
i ,, Wire galv. No. 1, P.O. Qual... ,,	£20	—
g Lead, English Pig ... ,,	£14	5s. dec.
g Mercury ... per bot.	£11 7/6 to £11 17/6	—
e Mica (in original cases) small ... per)lb.	6d. to 1/–	—
e ,, ,, medium ... ,,	5/– to 10/–	—
e ,, ,, large ... ,,	10/6 to 17/6 & up	—
b Phosphor Bronze, plain castings ... ,,	1/1	—
b ,, ,, drawn bars & rods ,,	11d.	¼d. inc.
b ,, ,, rolled strip & sheet ,,	10¼d.	¼d. inc.
b ,, ,, wire ... ... ,,	11¼d.	¼d. inc.
o Platinum ... ... per oz.	£7	—
d Silicium Bronze Wire ... ... per lb.	7½d.	¼d. inc.
r Steel, magnet, in bars ... ... ,,	7¼d.	—
g Tin, Block (English)... ... ... per ton	£216 10s.	—
n ,, Wire, Nos. 1 to 16 ... ... per lb.	3/8	—

Quotations supplied by :—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta Percha and Telegraph Works Co., Ltd.
g Henry Gardner & Co., Ltd.
h Edward Till & Co.
i Bolling & Lowe.
n P. Ormiston & Sons.
o Johnson Matthey & Co.
p C. Clifford & Sons, Ltd.
r W. F. Dennis & Co.

Orders Recently Booked

The British Broadcasting Corporation has again chosen Manchester-built Diesel engines for new developments at the North Scottish and North-East England broadcasting stations. Recent orders received by Messrs. Crossley Brothers, Ltd., include contracts for two sets of 6-cylinder, 6-crank vertical Diesel engines, each of 600 b.h.p. capacity, for these stations. The engines are similar to the ones already installed by the B.B.C. at Broadcasting House, London, and at the Scottish and West Regional stations.

Among the orders recently received by International Combustion, Ltd., are an electrical precipitation and grit-handling plant for the North Wilford "B" power station extensions for Nottingham Corporation, and electrical precipitation plant for the Kirkstall power station of Leeds Corporation.

In connection with extensions to the electrification of the South African Railways, the British Thomson-Houston Co., Ltd., through its South African representatives, Wilson & Herd, Ltd., has received from the Electricity Supply Commission the largest single contract ever placed for mercury-arc rectifiers for inverted operation. The order includes eighteen rectifiers, which are to be installed in nine sub-stations—there being four on the Cato Ridge-Durban section, and five on the Glencoe-Volksrust section. The incoming supply will be 88,000 V, 3-phase, 50 cycles, while the outgoing will be 3,000 V d.c. Each sub-station will include a step-down transformer with two secondary windings, each connected to a mercury-arc rectifier. The contract also includes a large number of high speed circuit-breakers similar to those at present used throughout the existing 3,000-V electrified section of the South African Railways.

Messrs. C. A. Parsons & Co., Ltd., have recently received from the Saskatchewan Power Commission an order for a 1,500-kW geared turbo-alternator complete with condensing plant for the North Battleford power station in the province of Saskatchewan. The turbine is to be of the pass-out type, driving the alternator at 1,200 r.p.m by means of double-helical reduction gearing.

British Insulated Cables, Ltd., has received from the Metropolitan-Vickers Electrical Co., Ltd., an order for the overhead equipment required in connection with the contract recently secured by that company for the electrification of the Central Railway of Brazil. The order is for the equipment of approximately 112 miles of single track within the suburban section of the Central Railway of Brazil at Rio de Janeiro, and includes the overhead equipment of the track, with transmission lines to sub-stations and signal power supply, together with all rail bonding.

Lamp Capping Cement

An important item in the make-up of an electric lamp is the cement employed to bind the cap, the bulb and the terminals together. It has to be capable of withstanding the heat generated in the lamp and must also possess the requisite mechanical strength. Messrs. Birkbys, Ltd., have sent us a leaflet dealing with their "Grade C.30" "Elo" lamp capping cement which is mixed with methylated spirit to form a paste. Upon application this is stoved at 195-200 deg. C. for three and a half minutes. Tests have shown the cement to have a breaking strain of 55 lb.-in.

Social Events

The annual dinner and dance of the Sloan Electrical Co.'s Social Club was held last Saturday evening. Mr. L. G. Sloan, who has been president of the club since its inception, took the chair and proposed the loyal toast. Mr. W. J. Bensley proposed the chairman's health, and this toast was received with musical honours. He announced that a new indoor sports section had recently been added. Mr. Sloan, who replied to the toast, was presented with an umbrella by the club members. In toasting the company, Mr. H. D. Denman, general manager, kept the diners in good humour with a witty and lively speech, to which Mr. M. V. Ely, managing director, responded, stressing the value of the unity of policy amongst the staff and directors. Mr. J. McLennan, a director, proposed a toast to "Our Friends," the response being made by Mr. F. C. Guildford, director of L. G. Sloan, Ltd. The dinner was followed by a dance.

There was considerable hilarity at the Fortune Theatre on Monday and Tuesday last when the G.E.C. Dramatic Society presented the farcical comedy "Just Married," by Adelaide Matthews and Anne Nichols. The bulk of the fun was provided by Mr. R. Levenger as "Jack Stanley," and Mr. W. Avenell as "Robert Adams," who, supported by an able company in which there were many familiar faces, made the most of the many humorous situations which this play provides. Miss Sheila Cooper, who played "Roberta Adams," is a newcomer and proved to be an acquisition. The performances were the Society's annual effort in aid of the Infants' Hospital, Westminster, and there was a well-filled house on both evenings.

The recently formed Clesco Car Club of the County of London Electric Supply Co., Ltd., is holding its first rally on April 28th. The club will meet at Barking power station at noon, and lunch at 12.30 p.m. in the dining room there, after which there will be a conducted tour of the station. Tea will be taken at the sports pavilion at Raynes Park, and a film will be shown of the company's activities, &c., the rally concluding with a carnival dance.

The first annual dinner and dance of the Hove E.D.A. Circle was held on April 3rd at the Lido Cinema. Ald. H. J. Galliers, in proposing the toast of "The Corporation of Hove," referred to the co-operative link which the Circle had formed with the Corporation. Mr. F. Swarbrick, chairman of the Circle and borough electrical engineer, said it was up to the members of the Association to lead the way in the Jubilee illuminations, for which the Electricity Department was offering a special rate of 1d. per kWh. Other speakers were Ald. W. H. Payne, Councillor C. S. Loadsman (Mayor of Hove), and Mr. P. C. Honey (E.D.A.). Mrs. Loadsman, on behalf of the members of the Circle, presented Mr. A. J. Reynolds, hon. secretary, with a silvered electric coffee-pot in recognition of his services to the Circle.

For Sale

Torquay Electricity Department has for disposal two 1,000-kW turbo-alternators, complete with surface condensers.

Aylesbury Electricity Department has for sale d.c. house-service meters.

(See our classified advertisements.)

The King's House

A considerable amount of electrical apparatus is being installed in the house which the Royal Warrant holders are presenting to the King in commemoration of his twenty-five years' reign. Among the companies who are supplying apparatus are the Edison Swan Electric Co., Ltd. (lamps and cable; Hotpoint Electric Appliance Co., Ltd. (washing machine, fans, &c.); A. P. Lundberg & Co., Ltd. (switches and plugs); Julius Sax & Co., Ltd. (bells); Harcourts, Ltd., Allom Brothers, Ltd., Best & Lloyd, Ltd., Cecil Ern & Co., Ltd., F. Thomas & Co., and Louis Dernier & Hamlyn, Ltd. (lighting fittings); Berry's Electric, Ltd., Bratt Colbran & Co., Ltd., Carron Company, and Leeds Fireclay Co., Ltd. (fires); Gramophone Co., Ltd. (gramophone and radio); Electrolux, Ltd. (refrigerator); Automatic Electric Co., Ltd. (telephones); Hoover, Ltd. (vacuum cleaners); and H. W. Rodda (washing-up machine).

New Catalogues and Lists

Kolster-Brandes, Ltd., Cray Works, Sidcup, Kent.—An illustrated and priced technically descriptive booklet on the "Rejectostat" community aerial system, particularly applicable to blocks of flats, hotels, &c., which has been extended to enable up to 1,000 radio receivers to be operated simultaneously off a single aerial.

British Insulated Cables, Ltd., Prescot, Lancs.—Leaflet, P.F.166, dealing with flat twin tough rubber sheathed cable for temporary Jubilee illuminations.

Provincial Incandescent Fittings Co., Ltd., Pifco House, High Street, Manchester.—Fully illustrated spring catalogue giving prices and particulars of "Pifco" electrical decoration sets and lamps, valves, torches, batteries, testing instruments, &c.

Hotpoint Electric Appliance Co., Ltd., 24, Newman Street, Oxford Street, W.—A three-page folder pointing out some of the advantages of the "Hotpoint Junior" vacuum cleaner.

Stanley Electrical Co., Ltd., Latimer Works, Teddington.—Particulars of time-switches for street and shop-window lighting.

G. & J. Weir, Ltd., Cathcart, Glasgow, S.4.—A leaflet on castings and forgings in Monel metal.

Euston Manufacturing Co., Ltd., 143B, Euston Road, N.W.1.—A complete catalogue of electric lighting fittings.

Laminated Gears, Victoria Works, Millhouses, Sheffield.—A booklet on laminated gears.

C. Churchill & Co., Ltd., Albert Street, Birmingham.—A new twenty-four-page house journal containing a number of articles on tools and modern production practice.

Brown Brothers, Ltd., Great Eastern Street, E.C.2.—An aerial view of the City of London, in which Brown's Buildings are easily discernible.

Charles Taylor (Birmingham), Ltd., Bartholomew Street, Birmingham, 5.—A catalogue of capstan lathes.

Dulcetto-Polyphon, Ltd., 2, Newman Street, Oxford Street, W.1.—A Jubilee illumination display leaflet.

Switchgear & Cowans, Ltd., Elsinore Road, Old Trafford, Manchester, 16.—A catalogue on S. & C. internal isolation switchgear.

James Gordon & Co., Ltd., Regent House, Kingsway, W.C.2.—Leaflets dealing with automatic boiler control and a thermostatic high and low water level alarm and distance indicator.

T. W. Ward, Ltd., Albion Works, Sheffield.—A pamphlet on double drum electric hauling and winding engines.

S. Rose & Co., Ltd., 111, Gray's Inn Road, W.C.1.—Details of liquid-level indicators.

Bankruptcy Proceedings

S. F. Philpott, lately trading as the S.F.P. Electrical Co., Banbury, Oxon, electrical engineer.—The public examination was held at the Town Hall, Banbury, on April 3rd. The statement of affairs submitted showed liabilities of £1,877 and net assets of £445, leaving a deficiency of £1,432. Debtor said he commenced business as an electrical engineer in November, 1932, with borrowed capital. In the first twelve months he made a profit, but at the end of last year he undertook a contract for electrical advertising signs, which work had resulted in a loss. The examination was adjourned for the signing of the notes.

C. Worden, 5, St. Alban's Road, Darwen, lately 89, Duckworth Street, Darwen, electrical engineer and radio dealer.—At the recent public examination of this debtor held at Blackburn it was disclosed that the liabilities amounted to £375 and the assets to £60. Debtor attributed his failure to inexperience and shortage of capital. The examination was concluded.

A. D. M. Mayer, electrical engineer and wireless specialist, 75, Pasture Road, Goole.—Receiving order made March 28th on debtor's own petition.

H. T. Ballantyne, electrical engineer, 14, Waterloo Crescent, Bramley, Leeds.—Public examination May 7th at the County Court House, Leeds.

J. Holder, electrical engineer, 31, Denehurst Gardens, Richmond.—First meeting April 12th at 29, Russell Square, W.C. Public examination May 8th at the Court House, Garratt Lane, Wandsworth.

E. W. Hills, radio dealer, 20, Havelock Road, Hastings.—Trustee, Mr. L. C. Clark, 24, Ship Street, Brighton, appointed March 28th.

R. Robinson, electrical engineer, The Arcade, Waterfoot.—Last day for receiving proofs for dividend April 17th. Trustee, Mr. R. K. Clark, Byrom Street, Manchester, Official Receiver.

H. Gallie, wireless accessory dealer, Tidworth Market, Tidworth.—Last day for receiving proofs for dividend April 16th. Trustee, Mr. H. T. Jones, 12, Rolleston Street, Salisbury, Official Receiver.

J. D. Dickinson, wireless and electrical dealer, 671, Chesterfield Road, Sheffield.—Last day for receiving proofs for dividend April 17th. Trustee, Mr. L. J. Clegg, 14, Figtree Lane, Sheffield, Official Receiver.

H. Barker (Broadway Radio Stores), radio dealer, 848, Manchester Road, Bradford.—First and final dividend of 7s. 0½d. in the £, payable April 10th at 71, Manningham Lane, Bradford.

W. H. Tordoff, electrical engineer, 10, Burnett Avenue, Manchester Road, Bradford.—Receiving order made April 1st on debtor's own petition.

R. S. Lonsdale, wireless dealer, 3, Dodworth Road, Barnsley.—First meeting April 12th at the Official Receiver's office, County Court Hall, Regent Street, Barnsley. Public examination May 23rd at the County Court Hall, Barnsley.

L. L. Morgan, radio and electrical engineer, 7, High Street, Purley.—First meeting April 17th at 29, Russell Square, W.C. Public examination May 30th at the County Court, Scarbrook Road, Croydon.

E. Brown, trading as "The World's Wireless Stores," 10 & 12, Grosvenor Parade, and Forsdick Yard, Wallington, and as "J. Morton," 3, Church Yard, Croydon.—Trustees, Messrs. L. W. Moscrop, 60, Strand, W.C., and F. W. Davis, 58, Theobald's Road, W.C., released February 26th.

I. Mac. Walker and **D. B. Beavan,** radio and electrical retailers, 2, The Arcade, Swiss Cottage Station, Hampstead, N.W.—Last day for receiving proofs for dividend April 23rd. Trustee, Mr. W. A. J. Osborne, Balfour House, Finsbury Pavement, E.C.

J. Keddie, electrician, 90, Leander Road, Brixton, S.W.—First and final dividend of 1s. 8d. in the £, payable any day at Bankruptcy Buildings, Carey Street, W.C. Discharge suspended for eighteen months until September 7th, 1936.

A. H. Duffin and **G. Kershaw** (A. H. Duffin & Co.), electrical engineers and contractors, Provincial Buildings, Conway Road, Colwyn Bay.—Supplemental dividend of 1⅝d. in the £, payable April 17th at the Official Receiver's office, St. Peter's Churchyard, The Cross, Chester.

Company Liquidations

Radialaddin (Branches), Ltd., 46, Brewer Street, and 21, Denman Street, W.—The statutory first meetings of creditors and shareholders under the compulsory liquidation of this company were held on April 3rd at Carey Street, W.C., before Mr. Ormrod, Assistant Official Receiver. The company was promoted in April, 1933, by Edward Godal, to carry on business as manufacturers of, dealers in, and agents for the sale of radio sets. Godal acquired for the company the sole selling rights of certain radio sets in Great Britain and arranged for their sale through Universal Distributors, Ltd. He was voted £800 in £1 shares for his services. In June, 1933, Miss M. H. Donne (a director) advanced £1,000 to the company on the security of 8 per cent. debentures. The trading accounts show a net loss of £1,585 on the trading during the company's existence. On May 30th, 1934, the company's assets, valued at £600, were sold to Radialaddin (Disposals), Ltd. The Manchester branch was closed in the previous March, but the company continued to act as agents for Radialaddin (Disposals), Ltd., in connection with hire-purchase agreements. The company's failure was attributed to intense competition, to alleged breach of agreement by concerns who undertook to sell exclusively to the company, to the loss of a considerable sum lent to the parent company, and to ill-repute in the trade caused by the petition presented against the parent company. The liabilities are estimated at £2,217, against assets of £6. The liquidation was left in the hands of the Official Receiver.

Solidite & Synthetic Mouldings, Ltd.—Winding up voluntarily. Liquidator, Mr. S. E. Smith, 4, Broad Street Place, E.C.

Economic Household Appliance Co., Ltd.—Particulars of claims by April 30th to the liquidator, Mr. A. W. Hardwick, 196-198, High Street, Stoke Newington, N.

Rugby Electrical Engineering Co., Ltd.—Meetings May 10th at 11a, Regent Street, Rugby, to receive an account of the winding-up by the liquidators, Messrs. G. H. Scott and A. Cripwell.

Brownie Wireless Co. of Great Britain, Ltd.—Meetings May 2nd at 37, Walbrook, E.C., to receive an account of the winding-up by the liquidator, Mr. A. J. Foster.

Electric Tubular Heating Co., Ltd.—Winding up voluntarily. Liquidator, Mr. R. Mountstephen, 15, Eastcheap, E.C.

British Lumophon, Ltd.—Winding up voluntarily. Liquidator, Mr. W. L. Norman, 169, Regent Street, W.

Umello, Ltd.—Winding up voluntarily. Liquidator, Mr. A. L. Sutcliffe, 10, Coleman Street, E.C.

Trojan (Manchester), Ltd.—Particulars of claims by May 11th to the liquidator, Mr. W. S. Berry, 13, St. Ann Street, Manchester.

Dissolutions of Partnership

Hassans, electrical and radio engineers, 407, Birmingham Road, Wy[illegible]e Green.—Messrs. F. W. Hassan and F. W. Babb have disso[illegible]d partnership. Mr. Hassan will attend to debts and carry [illegible] the business.

Majestic [illegible]rvice Co., radio and electrical engineers, 4, Victo[illegible]a Bridge Street, Salford.—Messrs. C. H. Marks, R. Marks and H. Smith have dissolved partnership. Messrs. C. H. and R. Marks will attend to debts and carry on the business.

Electricity Supply

Lighting, Domestic, Power

Aldershot.—REVISED CHARGES.—The Town Council has approved the following revised charges: Ordinary lighting, 4½d. per kWh for the first 500 kWh a quarter and 3½d. per kWh beyond; domestic heating and cooking (where electricity is also used for lighting), ¾d. per kWh; power, 2½d. per kWh for the first 1,000 kWh a quarter, 2d. for the next 1,000, 1½d. for the third 1,000, and 1¼d. beyond 3,000 kWh per quarter.

Barrow-in-Furness.—CHANGE-OVER.—The electrical engineer has been authorised to proceed with the changing-over from d.c. to a.c. of the Hindpool area between Nelson Street and Chatsworth Street, and from Holker Street to Hindpool Road. It is proposed to replace the existing mains by larger four-core cables. The total cost of the work is estimated at £10,000.

LOAN.—The Electricity Committee is to borrow £20,000 for mains and services.

LOWER CHARGES.—Electricity charges have been reduced by 1d. per kWh.

Bellshill.—STREET LIGHTING.—The Lanarkshire C.C. is to provide electric street lighting in place of gas lighting at a cost of £2,500. Electric lighting is also to be installed in the Council's schools at Tannochside and New Stevenston, for which the cost will be £590.

Birkenhead.—EXTENSION OF AREA.—The Electricity Committee is to apply to the Electricity Commissioners for an order to include the estates of Port Sunlight and Bromborough within the Corporation's area of supply.

LOAN.—Application is being made for sanction to a loan of £17,000 for plant and mains.

Bolton.—SUB-STATION.—The Electricity Committee is borrowing £25,000 for sub-stations and equipment.

Colchester.—NEW MAINS.—The Electricity Committee is to lay mains to the Old Heath housing site, at a cost of £542; Margaret Road (£300); Inworth (£780); Lee Wick, Point Clear, and St. Osyth Stone (£2,293).

Douglas (I.O.M.).—SUPPLY EXTENSION.—Arrangements have been made for the Corporation to supply electricity to part of the Howstrake estate.

Escrick.—OVERHEAD LINES.—The Rural District Council has consented to the York Electricity Department erecting overhead lines at Dunnington.

Glasgow.—NEW GENERATING PLANT.—The Electricity Committee has received a letter from the manager for Scotland of the Central Electricity Board asking that there should be as little delay as possible in making the preliminary arrangements for the installation at Dalmarnock generating station of an additional 50,000-kW turbo-alternator and three boilers, each having a normal evaporative capacity of 200,000 lb., to be available for commercial operation by November, 1937, and a further similar installation of generating plant and boilers to be available by the winter of 1938. The Committee has decided to authorise the application to the Electricity Commissioners for their consent to the proposed extensions, and to issue specifications and invite tenders.

Gravesend.—AN ALL-ELECTRIC HOUSE.—The Housing Committee has agreed to place one of the houses on the West Court Farm housing estate at the disposal of the Electricity Committee for the purposes of an experiment in all-electric supply.

Grindleton.—EXTENSIONS.—Subject to the necessary wayleaves and sanction to a loan of £1,880 being obtained, overhead lines are to be extended from Leagran to Whitewell and on to Radholme Laund and Middle Lees.

Hull.—NEW EQUIPMENT.—The Electricity Committee recommends that a 30-cwt. electric mobile crane costing £1,100 be installed at the Sculcoates generating station, where the coal-handling plant is to be improved at a cost of £3,000.

AN ELECTRIC PUMP.—The Works Committee is to install an electrically driven pump in the West Hull drainage building at an estimated cost of £3,300.

LOANS.—Sanction is sought to a loan of £15,000 for prepayment meters and has been obtained for a loan of £50,000 for mains, services and sub-stations.

Ilford.—CHANGE-OVER.—The Electricity Committee has authorised the change-over from d.c. to a.c. in another district at a cost of £3,000.

Kirkcaldy.—STREET LIGHTING.—The electrical engineer stated at a recent meeting of the Town Council that an improvement in street lighting is urgently required, and suggested that experiments should be made with electric-discharge lamps.

Leeds.—KIRKSTALL POWER STATION EXTENSION.—The electrical engineer has been requested by the Central Electricity Board to submit an estimate for a further extension of the Kirkstall power station.

London.—L.C.C.—As an experiment the London County Council is to floodlight the playground of a board school in its area for the purpose of games during the winter evenings.

LEWISHAM.—The Council has acceded to a request by the South Metropolitan Electric Light & Power Co., Ltd., that it should be allowed to erect lamps adjoining a demonstration of gas lamps in Brownhill Road in order that the two systems may be compared.

WOOLWICH.—The Council is reducing electricity charges as follows:—Domestic tariff for lighting, heating and cooking and the shop lighting tariff from £16 to £13 per annum per kW of maximum demand, plus ½d. (same) per kWh; lighting flat rate from 6d. to 5d. per kWh; sign and similar outside lighting from £8 to £7 per kW of maximum demand, plus ½d. (same) per kWh.

Maidstone.—MAINS EXTENSIONS.—The Town Council is to extend the mains to Ditton to supply the quarries of Eagleton and Cockrane at a cost of £400, to Wateringbury (£672), and to West Farleigh (£108).

Manchester.—INSTALLATIONS IN MUNICIPAL FLATS.—The Housing Committee is considering a report setting out alternative schemes for the lighting and heating by gas and/or electricity of the municipal flats. The decision in the matter has been deferred, but in the meantime the flats at Collyhurst and West Gorton are to be equipped throughout with electrical services.

Newcastle-on-Tyne.—PURCHASE PROPOSAL.—It has been proposed to the City Council that a special committee shall be appointed to inquire into the question of the Council's exercising its option to purchase the electricity supply undertakings within the city area in 1937.

Norwich.—NEW STREET LIGHTING.—A system of street lighting utilising electric-discharge lamps was switched on last week.

Oswestry.—RURAL ELECTRIFICATION.—The Town Council proposes to borrow £14,633 for the electrical development of the rural area.

Oxford.—GRID SUPPLY DECISION.—The City Council has decided unanimously to cease to generate its own electricity and to enter into a fifteen years' agreement for taking a supply of electricity from the Central Electricity Board. It is expected that the agreement will mean a saving of between £60,000 and £100,000 to the Corporation.

Padiham.—LOWER CHARGES.—From the June quarter the "unit" charge for electricity for domestic purposes will be reduced from ¾d. to ½d. per kWh. The fixed charge will be reduced to 5 per cent. per quarter on the first £15 rateable value, 2½ per cent. on the next £15, and 1¼ per cent. on all over £30.

Reading.—CONVERTING PLANT.—Alterations, including the provision of a mercury-arc rectifier, are to be carried out to the plant at the transport depôt at a cost of £3,000.

Rothesay.—SUB-STATION.—The Clyde Trust is to erect an electricity sub-station at Rothesay Dock.

Southend-on-Sea.—THIS YEAR'S ILLUMINATIONS.—In addition to the Jubilee and the usual carnival and autumn illuminations (August 1st to October 20th), the Electricity Department has arranged for illuminations in connection with the Yachting Week (June 11th to 18th) and the Pier Centenary (July 24th to 31st). Decorative lighting outfits, complete with seventy-two coloured lamps and connecting cable, are to be hired out by the Department for £4 for the whole period, May 1st to October 20th.

Southport.—ILLUMINATIONS.—A sum of about £1,000 is to be spent by the Electricity Committee on illumination schemes.

SUB-STATION EXTENSION.—The Electricity Committee is to extend the Glaciarium sub-station at a cost of £1,200.

South Shields.—The Electricity Committee has received sanction to borrow £10,000 for services for the electricity undertaking.

Stalybridge.—POWER STATION EXTENSIONS.—Mr. J. H. Lumsden, engineer to the Stalybridge, Hyde, Mossley and Dukinfield Joint Electricity Board, reported that the Central Electricity Board had proposed that the Hartshead station should be extended and the plant capacity increased by the provision of a 30,000-kW turbo-alternator with boilers and auxiliaries. The engineer was instructed to obtain the requisite tenders. The Tame Valley station is being remodelled, as suggested by the engineer, and a quotation of Messrs. W. H. George & Son, architects, for plans, bill of quantities and general supervision of the work has been accepted.

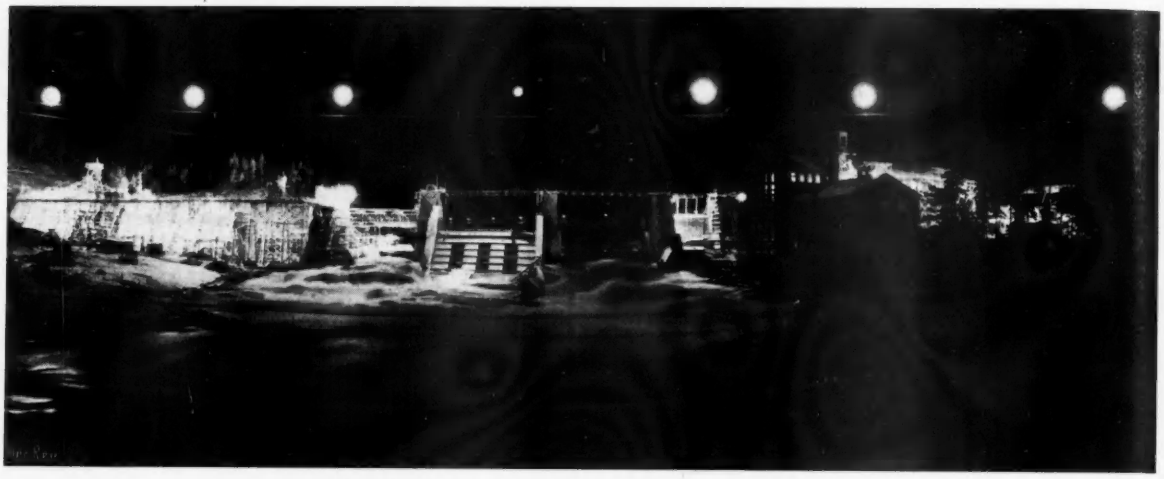
TWO-PART TARIFF METERS.—The Board has decided to install two-part tariff prepayment meters where required.

Stoke-on-Trent.—CHANGE-OVER.—The Electricity Committee is to effect a change-over in part of the Longton area at a cost of £3,800, and to improve the supply to Stone (£2,975).

Sutton Coldfield.—EXTENSIONS.—Schemes to supply the Edge Hill estate, estimated to cost £6,299, and to extend mains at a cost of £3,758 to supply the Somerville estate have been approved.

Sweden.—LARGE POWER STATION.—The hydro-electric power station utilising the Krangede Falls is now nearing completion. The cost of the first installation is estimated at 22 million kronor and it has been put in hand by an undertaking consisting of six large consumers of electricity, namely, the Sandviken, Fagersta and Hofors Ironworks, the Korsnäs Sawmills Co., the Stockholm Electricity Works, and the Bergslagen Power Co. The dam over the Indal River is of an overall length of 350 metres, including the intakes, and the maximum height is 18 m. above the river bed. For the present there

are only two turbo-generator units, with a capacity of 60,000 kW, but there is space for six, and when these are in place the power station will be the largest in Sweden. The turbines are of the vertical-shaft, single-runner Francis type, mounted in steel spiral casings, and the generators, coupled direct to the turbines, are rated at 35,000 kVA, 10 kV and 50 cycles, each being connected to a three-phase self-cooled 35,000-kVA, 10/220-kV transformer. The 10-kV bus-bars feed the station service transformers and also a



A night photograph of the Krangede power station under construction

15,000-kVA, 10/70-kV transformer which connects the station to the Hammarforsen water-power station situated 20 km. below Krangede. One of the secondary lines will connect the system with the Lanforsen and Alvkarleby power stations, while another will link up with a projected 70-kV line from Västerås. The contracts for the generators and main transformers were placed with the Allmänna Svenska Elektriska Aktiebolaget.

Tobermory (Argyllshire).—NEW PLANT.—The Town Council is to apply for sanction to install new plant, to alter the supply pressure from 220 to 230 V, and to obtain a loan for the necessary work.

Torquay.—PURCHASE FROM COMPANY.—The Electricity Committee has decided to purchase from the Teignmouth Electric Lighting Co., Ltd., that portion of the undertaking in the parishes of Stokeinteignhead and Haccombe-with-Coombe, including mains, sub-stations, meters and apparatus, for £8,000.

Wakefield.—SUB-STATION.—The Electricity Committee is to erect a sub-station on the Peacock Farm Estate.

Walsall.—MAINS EXTENSIONS.—The Electricity Committee is to extend mains at a cost of £9,500.

Warrington.—OVERHEAD LINES.—The Minister of Transport has consented to the placing overhead of certain 11,000-V

Jubilee Illumination Schemes

ARRANGEMENTS have now been concluded by the Regent Street Association for the floodlighting of the entire thoroughfare, for a period of three and a half years from next autumn, along the lines stated in the ELECTRICAL REVIEW of February 15th last. We are informed by Overhead, Ltd., that following demonstrations by competing firms at selected points of the street (a demonstration was also attempted by gas interests), its system, using equipment manufactured by the British Thomson-Houston Co., Ltd., has been unanimously chosen. The buildings will be floodlighted from the mezzanine floor up to the main cornice, and the band of stonework behind the cornice and special features will also be picked out. The method of floodlighting will be generally from balconies or short brackets projecting from the buildings, and no illumination from across the street will be attempted.

No charge is to be made by the County of London Electric Supply Co., Ltd., and its associated companies for electricity supplied to local authorities for special external illuminations in their areas between May 1st and June 6th. Private consumers in the London area will be charged ½d. per kWh and rural consumers ¾d. per kWh.

Mr. W. Phœnix, engineer and manager, Newton-in-Makerfield Electricity Department, has informed us that the town hall is to be decorated with coloured lamps, and Mesnes Park will be lighted for public use. The tennis courts and bowling and putting greens are to be floodlighted, while the gardens and general park will be treated with decorative lighting. Shopkeepers who introduce special lighting for the celebrations are to be supplied without special metering at a flat rate of 2d. per kWh.

Fitting B.T.H. projectors on the roof of the Admiralty for the Jubilee floodlighting of the Admiralty Arch

Local tradesmen at Gillingham (Kent) are to be invited to decorate and illuminate their premises, electricity being supplied at ¾d. per kWh for the purpose. The borough electrical engineer has also been authorised to floodlight the Gillingham and Rainham parish churches and the William Adams memorial and to erect coloured lamps in the Park and the Strand. Southampton Electricity Committee recommends reduced charges of ¼d. per kWh in the borough and ¾d. outside for additional supplies required for floodlighting purposes during May subject to a minimum charge of 10s. 6d. At Goring-on-Thames the church tower is to be floodlighted; while Bolsover Castle and Wainhorse Tower, Halifax, are to be similarly treated.

Elaborate electric lighting of the Hoe is to be the principal contribution of Plymouth Corporation. At Wimbledon the Electricity Committee has authorised the external illumination of the town hall at a cost not exceeding £500.

The Birmingham Circle of the Electrical Development Association has undertaken to provide the cost, so far as labour and materials are concerned, of illuminating the Council House. At Warrington the Electricity Committee has fixed a flat rate charge of ¼d. per kWh for electricity used for Jubilee illuminations during the week commencing May 6th, 1935. Of seven systems of illuminating the sea front and Madeira Drive as far as Duke's Mount, Brighton Electricity Committee has chosen that of Ionlite, Ltd., costing £3,386, and also suggests that the scheme of lighting should be continued throughout the summer.

The stonework of the Battersea Town Hall is now being repaired in preparation for a permanent floodlighting system. The Hendon Electric Supply Co. is providing energy without charge.

It is learned that illuminations at Belfast will be on a lavish scale. The Houses of Parliament, Royal Courts of Justice, City Hall, and the Albert memorial will be floodlighted, and arrangements are being made for the illumination of many other prominent buildings, while large firms in the centre of the city are promoting their own schemes of illumination and decoration. Similarly, plans for floodlighting public buildings are being arranged at Londonderry.

Electricity will be supplied without charge to merchants and shopkeepers in Pretoria from May 6th to 11th for the special display of goods and for lighting of shop windows, states a *Reuter* message.

The Rotherham Electricity Committee has agreed to supply electricity for the illumination of approved outside displays.

lines for the transmission of energy in the urban district of Lymm and in the rural district of Bucklow.

LOAN.—The Electricity Committee is to borrow £20,000 for mains and services.

Weetslade (Northumberland). — OVERHEAD LINES. — The Council has approved plans for the erection of overhead lines at Seaton Burn by the North-Eastern Electric Supply Co., Ltd.

Whitby.—LOWER CHARGES.—The Urban District Council has reduced the lighting tariff from 5½d. to 5d. per kWh and the domestic tariff from 1d. to ¾d. per kWh.

Wolverhampton.—MAINS EXTENSIONS.—The Electricity Committee is seeking sanction to borrow £25,000 for mains extensions.

Worksop.—YEAR'S WORKING.—The statement of accounts of the Electricity Department for the year ended March 31st, 1934, sent to us by Mr. M. S. Mason, the borough electrical engineer, was received too late for inclusion in last week's table. A total revenue of £38,740 is shown, working expenses amounting to £28,083. The net profit was £7,009.

Worthing.—LOANS SANCTIONED.—The Electricity Committee has obtained sanction to borrow £25,000 for mains and services, £2,500 for consumers' wiring installations, and £25,000 for electrical apparatus.

Traction

Denmark.—ELECTRIFICATION JUSTIFIED.—Electrification of the Copenhagen suburban lines increased the traffic by 200 per cent. during the six months after the opening in May, 1934.

FAST TRAINS.—The first of the four streamlined and articulated Diesel-electric trains of the Danish State Railways is now being tested. From May 15th 60-m.p.h. services are to be run with these units between Copenhagen, Aalborg, Esbjerg, and Aarhuus. Each train is driven by four traction motors energised by two 550-b.h.p. Diesel-generator sets.

Germany.—HIGH-SPEED ELECTRIC TRAINS.—Commencing with the inauguration of the summer time-tables on May 15th, new 820- and 1,200-b.h.p. Diesel-electric trains of the "Flying Hamburger" type will run from Cologne to Berlin and back at an average speed of 70 m.p.h., and from Frankfurt to Berlin and back at 66 m.p.h. In the course of these runs the 157.7 miles from Berlin to Hanover will be covered in 115 min. (82.3 m.p.h.), and the 102.3 miles from Leipzig to Berlin in 76 min. (80.9 m.p.h.). On the same date the new high-power single-phase electric trains (illustrated recently in the ELECTRICAL REVIEW) will be put into regular service on the newly electrified line between Augsburg and Nürnberg at a schedule speed of 54.55 m.p.h., including two stops.

India.—RAILWAY SCHEMES.—Our Bombay correspondent reports that the programme of railway equipment in India for 1935 to 1936 includes the installation of new generating plant at the Kharagpur workshops on the Bengal to Nagpur railway at a cost of Rs.10 lakhs, and also electrification of the larger stations (Rs.6 lakhs). On the B.B. & C.I. Railway the Bombay suburban electrification will be extended to Virar at a cost of Rs.16 lakhs. On the East Indian Railway, Bhagalpur, Sahebgunge and other stations will be electrified at a cost of Rs.87 lakhs. Several smaller projects are also contemplated.

Italy.—ELECTRIC VEHICLE PROGRESS.—The Societa Tecnomasio Italiano Brown-Boveri, Milan, has now taken up the construction of electric vans and trucks ranging in capacity from 2 to 4½ tons, and also 20- and 40-seater trolley-buses.

Liverpool.—TRAMWAY EXTENSIONS.—A proposal to promote an Order under the Light Railways Acts to authorise the construction of eleven tramway extensions has been approved by the Council.

Norway.—NEW ELECTRIC RAILWAY.—An electric railway 17 miles long, between Eide and Voss, has recently been opened. The supply is at 15,000-V single-phase.

Southend-on-Sea.—TROLLEY-BUS EXTENSIONS.—The Town Council is negotiating for an extension of the trolley-bus route from Priory Park to Eastern Avenue.

Communications

France.—TELEVISION CONGRESS.—An international television congress arranged by the International Institute of Educational Cinematography of Rome was opened at Nice last week. France, Italy, Germany and America were represented, while the English delegates included Mr. Baird, of the Baird Television Company, and Mr. K. W. Hayes, representing the British Broadcasting Corporation. According to an *Exchange* message from Nice, Mr. Hayes said that in addition to the London television stations to be opened at the end of July Great Britain would have fifteen stations opened within two years.

DIRECT LINK WITH UNITED STATES.—At present it is only possible to telephone between the United States and Europe *via* London, but the French Minister for Posts, Telegraphs and Telephones has proposed to the United States Government the establishment of a direct wireless telephone service between the two countries, learns *Reuter's Trade Service* from Paris. Preparations are already being made in France for the service to come into operation before next winter.

BETTER TELEPHONE FACILITIES.—Hitherto, in Paris, it has been usual for the public to telephone from a café, and it was only in the important railway termini and the main post offices that call boxes could be found. Now, according to *Reuter*, easily accessible public telephones are to be installed, a call box being placed in each of the underground stations. The charge will be 50 centimes (1¾d.) for a three-minutes call within the Paris radius.

Great Britain.—TRUNK TELEPHONE CABLE.—The work of laying a new trunk telephone cable from Glasgow to London *via* Liverpool has now reached the vicinity of Kidderminster, Worcs, progress being at the rate of approximately 5,000 yd.

Laying a section of the Glasgow to London trunk telephone cable between Bridgnorth and Kidderminster

per week. From Glasgow to Liverpool the cable consists of 180 pairs of wires, and that which is now being laid contains 360 pairs of wires and four screened radio broadcast circuits for the use of the B.B.C.

Hull.—TELEPHONE EXTENSIONS.—The Telephones Committee has obtained sanction to borrow £40,000 for extensions.

Scotland.—TELEPHONY TO THE ISLANDS.—Steps are being taken to link up Islay with the mainland by telephone, for which it would be necessary to lay a submarine cable from Port Ellen to Kintyre. Post Office officials are engaged in investigations on the islands of Coll, Tiree, and Gigha.

Electric Cooking in Holland

AT the conclusion of a course of lectures for senior demonstrators and saleswomen a dinner for E.A.W. diploma holders was held on April 5th, when Miss Halverhout gave an account of her experiences as chief demonstrator of the Amsterdam undertaking. Electric cooking was started there seventeen years ago with "Tricity" apparatus, but little was done until 1933, for while all except two per cent. of the population used electricity for lighting, the belief was general that cooking by electricity was expensive, and association with gas interests had prevented active propaganda. Progress was made through lectures in clubs and schools (which had electric kitchens), and through installation contractors, who had been active in recommending women clients to attend lectures at the demonstration kitchen situated above the showrooms. In Holland only one hot meal per day (with meat and potatoes) was usually taken; little baking or grilling was done, and the hot-plates were used far more than the oven. The hire-purchase scheme in force provided for a three weeks' trial of the cooker (which included proper utensils) with a meter to indicate the cost, and the first meal was cooked by a demonstrator, who taught not cookery but how to use the electric cooker. A course which included one demonstration and twelve lessons was given for 4s. 2d.; those who attended usually bought what they cooked. She considered that an assistant should do the cooking, not the lecturer. Men contractors were being encouraged to learn to cook in order to show how easy it was!

Mr. E. E. Sharp referred to the proportion of demonstrators who were life members of the E.I.B.A. as likely to be higher than in any section of the industry. Miss C. Haslett agreed, but reminded him that the greatest work of the E.A.W. lay among women outside the electrical industry. Dr. Schelling, who is responsible for electrification in the rural areas of North Holland, said that they used to look to Berlin for inspiration, but were now turning to Great Britain. They had equipped six domestic science schools without charge and had prepared demonstration films. An electric iron was presented to every bride. A questionnaire sent to 1,600 women showed that all except one were entirely satisfied. Mr. A. C. Cramb pointed out that water heating was an earlier development than cooking in Holland, and Miss Halverhout explained that gas geysers were regarded as unreliable.

Contract Information

When "Contracts Open" are advertised in our "Official Notice" pages the date of the "Electrical Review" containing the advertisement is given in parentheses below

Contracts Open

Ashford.—April 29th. Electricity Department. Kiosks. (See this issue.)

Australia.—Melbourne.—Posts and Telegraphs Department. May 28th. Telephone switchboards. (A.Y. 12985.)*
City Council. May 20th. Current limiting reactors. (A.Y. 12997.)*
Sydney.—Municipal Council. May 20th. On-load tap changing equipment for two transformers. (A.Y. 12991.)*

Bedford.—April 24th. Public Assistance Committee. Electric lighting at the Biggleswade Institution. Specifications from the County surveyor, Shire Hall; tenders to the clerk of the County Council.

Birmingham.—April 29th. Gas Department. Cooling tower and electrically driven rotary pumps. Specifications, &c., from the general manager and secretary, Gas Department, Council House; tenders to the chairman of the Gas Committee.

Blackpool.—April 23rd. Electricity Department. 1,750-kW motor convertor. (March 29th.)

Bromley.—April 15th. Electricity Department. Single- and three-phase static transformers. (April 5th.)

Burnley.—April 23rd. Electricity Department. 7,092 yds. of copper conductor (see this issue.)

Cardiff.—April 18th. Electricity Department. Three-phase transformers, and fire protection apparatus. (April 5th.)

Coventry.—April 15th. Electricity Committee. Demolition of two steel cooling towers. (March 29th.)

Cupar.—April 24th. Fife District Asylum. One year's supply of materials, including electrical fittings. Forms, &c., from the resident clerk of works, tenders to the medical superintendent.

Dorchester.—April 26th. Electricity Department. Electric motors. (See this issue.)

Dunstable.—April 17th. Bedfordshire County Council. Electric lighting installation at new Council school. Particulars from the clerk to the County Council, Shire Hall, Bedford.

Ealing.—April 15th. Electricity Department. Electric wiring of Selborne school, Greenford. Specifications, &c., from, and tenders to, R. Birt, borough electrical engineer and manager, Electricity House.

Eston.—April 15th. U.D.C. P.i. l.c. double steel tape armoured twin l.p. cable and street lighting equipment. Specifications, &c., from the electrical engineer, Council Offices, Grangetown-on-Tees.

Exeter.—May 8th. Electricity Department. Electric cookers and water heaters. (See this issue.)

Farnworth.—April 15th. Electricity Department. L.p. cables. (April 5th.)

Hove.—April 15th. Corporation. Electric lighting and heating at the sanatorium, Upper Portslade. Specifications, &c., from N. E. Chadwick, Public Health Office, Town Hall Annexe, Third Avenue; tenders to the town clerk.

Hull.—April 16th. Electricity Department. Electric mobile crane, heating installation at Dagger Lane depôt, and metal tank type rectifier. (April 5th.)

Ilford.—April 18th. Electricity Department. Four 500-kVA transformers and one electric van. (April 5th.)

Irish Free State.—Dublin.—May 6th. Electricity Supply Board. Boiler plant and auxiliaries. (April 5th.)
Kildare.—May 13th. County Board of Health and Public Assistance. Electrical installation at new Hospital for Communicable Diseases, Naas. Specifications, &c., from the architect, 87, Merrion Square, Dublin (deposit £15 15s.).

London.—St. Marylebone.—April 30th. Borough Council. Underground cables for the year ending May 31st, 1936. (April 5th.)

Manchester.—April 17th. Electricity Committee. Static transformers for sub-stations. (March 29th.)

Newport (Mon.).—May 13th. Electricity Department. Deaerating plant and motor-driven boiler feed pump and control gear. (See this issue.)

New Zealand.—Wellington.—Post and Telegraph Department. May 2nd. Telephones. (A.Y. 12978.)*
Public Works Department. June 13th. Oil-circuit-breakers. (A.Y. 12979.)*

Northern Ireland.—Omagh.—April 16th. Committee of Management of Tyrone and Fermanagh Mental Hospital. Various works, including electrical, at the Omagh Mental Hospital. Specifications, &c., from V. H. Murnaghan, Lisonelly House; tenders to the clerk of the Hospital.

Oban.—April 15th. Town Council. Electric lighting at seventy-two houses at Dalintart. Schedules from D. Galloway, burgh surveyor; tenders to town clerk.

Perth.—April 29th. Glass bulb mercury rectifiers. (See this issue.)

Portsmouth.—April 17th. City Council. Electrical work at St. Mary's Hospital, Milton. Specifications, &c., from the city engineer, Guildhall (deposit £1 1s.); tenders to the town clerk.

Richmond (Surrey).—April 26th. Waterworks Department. Horizontal centrifugal pump with electric motor. Specifications, &c., from the water engineer and manager, Hotham House, Heron Court (deposit £2 2s.); tenders to the town clerk.

Roxburgh.—April 20th. County Council. Electrical and heating works at Jedburgh Grammar school extension. Schedules from, and tenders to, G. J. Sheriff, county clerk, County Offices, Newtown St. Boswells.

Scunthorpe.—May 6th. Electricity Department. Stores and materials. (See this issue.)

Sheffield.—April 12th. Electricity Department. Two machine panels, one metering panel and two feeder panels. (April 5th.)

South Africa.—Port Elizabeth.—Municipality. April 25th. Transformers, cable and sundry electrical material. (A.Y. 12990.)*
Pretoria.—Union Tender and Supplies Board. May 3rd. Telephone switchboards.(A.Y. 12986.)*
Johannesburg.—Municipality. April 26th. Magneto telephone switchboards. (A.Y. 12975.)*

Southampton.—April 23rd. Electricity Department. Cables. (See this issue.)

Sunderland.—April 24th. Corporation. Electric delivery van. (See this issue.)

Swadlincote.—April 17th. U.D.C. Electric motors, centrifugal pumps and other apparatus for sewage disposal works. Particulars from Willcox, Raikes & Marshall, 33, Great Charles Street, Birmingham (deposit £2 2s.).

Torquay.—April 27th. Electricity Department. Cables. (See this issue.)

Uruguay.—Montevideo.—May 22nd. State Electricity Supply and Telephone Administration. Insulated copper wire. (A.Y. 12999.)*

Wakefield.—April 15th. West Riding Public Assistance Committee. Various works, including electrical, at the new casual wards, Tadcaster. Specifications, &c., from the West Riding architect, County Hall; tenders to the clerk of the County Council.

Warrington.—April 15th. Electricity Department. Transformer. (March 29th.)

West Hartlepool.—April 15th. Corporation. Meter locks. (April 5th.)

Weymouth and Melcombe Regis.—April 15th. Electricity Department. Cable. (April 5th.)

April 29th. Cables, transformer, 11,000-V panel and l.p. switchboard. (See this issue.)

Worthing.—April 20th. Electricity Department. E.h.p. and l.p. cables. (April 5th.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed

Australia.—Commonwealth.—P.M.G.'s Department. Accepted. Carrier programme equipment (£1,670).—Standard Telephones & Cables (A'sia), Ltd. Cable.—Metal Manufacturers, Pty., Ltd.; British Insulated Cables, Ltd.; Standard Telephones & Cables (A'sia), Ltd. Receivers and parts (£452).—British General Electric Co., Ltd. Cadmium-copper wire (£4,244).—Liverpool Electric Cable Co., Ltd. Trunk test boards (£3,380).—Siemens (Aust.) Pty., Ltd. Automatic telephone switching equipment.—Automatic Telephones, Ltd. (£15,439); British General Electric Co., Ltd. (£782).
New South Wales.—Mains Roads Department. Accepted. Automatic telephone switching equipment.—Siemens (Aust.) Pty., Ltd.; Automatic Telephones, Ltd. Instrument cords (£211).—Ericsson Telephone Mfg. Co.
Victoria.—State Electricity Commission. Accepted. Cadmium-copper conductor.—British Insulated Cables, Ltd. Circuit-breaker.—Siemens (Aust.) Pty., Ltd.

Barrow-in-Furness.—Electricity Committee. Accepted. For twelve months: Cooker control units.—J. A. Crabtree & Co., Ltd. Irons.—General Electric Co., Ltd. Kettles.—Premier Electic Heaters, Ltd. Cookers.—English Electric Co., Ltd.; Revo Electric Co., Ltd.; Simplex Electric Co., Ltd.; Hotpoint Electric Appliance Co., Ltd. Meters.—Chamberlain & Hookham, Ltd.; Landis & Gyr Ltd.; Metropolitan-Vickers Electrical Co., Ltd.; Measurement, Ltd. Transformers.—British Electric Transformer Co., Ltd.

Birkenhead.—Electricity Committee. Accepted. Wiring seventy-six houses under the assisted scheme (£283).—Economic Electric Co. Transformers.—Electric Construction Co., Ltd.; Brush Electrical Engineering Co., Ltd.

Colchester.—Electricity Supply Committee. Accepted. 3,000-kVA transformer (£956).—Metropolitan-Vickers Electrical Co., Ltd.

Glasgow.—Housing Committee. Accepted. Electrical installation at housing schemes: Springfield Road (£2,195).—A. Moore; Garngad Road (£443).—R. J. McIntyre.
Transport Committee. Accepted. Two additional boilers at Pinkston power station.—John Thompson Water Tube Boilers, Ltd. L.c. cable.—Craigpark Electric Cable Co., Ltd. Overhauling storage batteries.—Tudor Accumulator Co., Ltd.

Highgate.—L.C.C. Accepted. Electric goods lift at the Archway Hospital (£246).—Evans Lifts, Ltd.

Ilford.—Electricity Committee. Accepted. One 1,000-kW and one 500-kW rotary convertors (£2,400).—Whipp & Bourne, Ltd.

Keighley.—Electricity Committee. Accepted. Cables for twelve months.—British Insulated Cables, Ltd.; Metropolitan

Electric Cable & Construction Co., Ltd.; Crompton Parkinson, Ltd.

Leeds.—Electricity Committee. Accepted. Transformers for two years.—Electric Construction Co., Ltd.; English Electric Co., Ltd.. Cookers for the ensuing year.—Carron Company; Simplex Electric Co., Ltd.; Falk, Stadelmann & Co., Ltd.; Revo Electric Co., Ltd.

Sturtevant electrostatic precipitation plant.—International Combustion, Ltd.

Health Committee. Accepted. Internal telephones at St. George's infirmary (£180).—General Electric Co., Ltd.

Lincoln.—Electricity Department. Accepted. Materials required during the year ending March 31st, 1936: Meters.—Aron Electricity Meter, Ltd.; Venner Time Switches, Ltd.; Chamberlain & Hookham, Ltd.; Metropolitan-Vickers Electrical Co., Ltd.; Ferranti, Ltd. Cables.—Callender's Cable & Construction Co., Ltd. Cookers.—Jackson Electric Stove Co.; Simplex Electric Co. Joint and disconnecting boxes and house service type cut-outs.—W. T. Henley's Telegraph Works Co., Ltd. Compound.—Blackall Bros. & Berrys; Berry, Wiggins & Co.

London.—EAST HAM.—Electricity Committee. Recommended. Switchgear (£499).—Switchgear & Cowans, Ltd. Switchgear alterations at power station (£157).—A. Reyrolle & Co., Ltd. Distributor cable.—Enfield Cable Works, Ltd.

WOOLWICH.—Borough Council. Accepted. 22,000-V switch panel for the Eltham sub-station (£1,449).—English Electric Co., Ltd.

L.C.C.—Housing and Public Health Committee. Recommended. Electrical installations in blocks 13 and 17 of dwellings on the Clapham Park estate (£667).—Jacob, White & Co., Ltd.

Northern Ireland.—BELFAST.—Town Council. Electric lighting and fittings at the abattoir (£520).—Coolmore Electrical Works.

Electricity Department. Accepted. Turbine pump and switch-house at the Harbour power station (£23,000).—Courtenay & Co.

Penge.—U.D.C. Accepted. Electric lighting in houses on the Chesham estate (£295).—H. Stovell.

Scarborough.—Town Council. Accepted.—Electric cookers to be let out on hire.—Jackson Electric Stove Co., Ltd.

Seaham Harbour.—Electricity Committee. Recommended. Switchgear, transformers and cables for supply to sanatorium and vicarage (£600).—Londonderry Collieries, Ltd.

South Shields.—Town Council. Accepted. Electrical installation in eighty-six houses in Wenlock Road (£455).—A. J. Harrison.

Electrical supplies for twelve months.—Siemens Electric Lamps & Supplies, Ltd.; J. L. Miller & Co.; General Electric Co., Ltd.; British Electrical & Manufacturing Co.; Falk, Stadelmann & Co., Ltd.; Metallic Seamless Tube Co., Ltd.

Stoke-on-Trent.—Electricity Committee. Accepted. sub-station switchgear and static transformers.—Metropolitan-Vickers Electrical Co., Ltd. Mains and cables.—Callender's Cable and Construction Co., Ltd.

Wolverhampton.—Electricity Committee. Accepted. Two 200-kVA transformers (£181).—Electric Construction Co., Ltd.

Worcester.—City Council. Accepted. Twelve months' supply of two-part tariff prepayment meters.—Venner Time Switches, Ltd.

Forthcoming Events

Institution of Electrical Engineers (*Irish Centre* (*Dublin*)).—Friday, April 12th. Gaiety Theatre, Dublin. 4 p.m. Faraday Lecture: "Electricity in the Life of To-day." Prof. E. W. Marchant. (*London Students' Section*).—Friday, April 12th. Institution, London. 7 p.m. Address by Prof. W. M. Thornton. (*Tees-Side Sub-Centre*).—Monday, April 15th. Cleveland Technical Institute, Middlesbrough. 6.45 p.m. Particulars to be announced later. (*Western Centre*).—Monday, April 15th. Guildhall, Plymouth. 7 p.m. Discussion on "Street Lighting by Electricity." To be opened by Mr. H. Midgley. (*Mersey and North Wales* (*Liverpool*) *Students' Section*).—Tuesday, April 16th. The University, Liverpool. 7.30 p.m. Annual general meeting. (*South Midlands Students' Section*).—Tuesday, April 16th. James Watt Memorial Institute, Birmingham. 7 p.m. Annual general meeting. "The Improvement of Load Factor." Mr. T. G. Procter. (*Sheffield Sub-Centre*).—Wednesday, April 17th. Royal Victoria Hotel, Sheffield. 7.30 p.m. "Electrical Control of Road Traffic by Vehicle Actuation." Mr. T. P. Preist.

Birmingham Electric Club.—Friday, April 12th. Grand Hotel, Birmingham. 7 p.m. "The National Physical Laboratory." Dr. R. L. Smith-Rose. Monday, April 15th. Walmley Golf Club. Spring meeting.

Electrical Association for Women.—Friday, April 12th. Park Lane Hotel, W.1. 9 p.m. Annual ball.

Electrical Industries Benevolent Association.—Friday, April 12th. Savoy Hotel, W.C.2. 12 p.m. Annual general meeting. 1 p.m. Luncheon.

Association of Mining Electrical Engineers (*South Wales Branch*).—Saturday, April 13th. South Wales Institute of Engineers, Cardiff. 6 p.m. "Utilisation of Electricity in Coal Production." Messrs. D. L. Metcalf and J. Hancock.

Association of Supervising Electrical Engineers.—Tuesday, April 16th. Brettenham House, W.C.2. 7.15 p.m. "The Importance of the Home Installation." Miss Caroline Haslett.

Makers' Names Wanted

ROYCE electric fan.

Notes

Generation of Electricity

The official returns rendered to the Electricity Commissioners show that 1,507 million kWh was generated at authorised undertakers during March, as compared with the revised figure of 1,391 million kWh in the corresponding month of 1934, representing an increase of 116 million kWh, or 8.3 per cent. The number of working days in the month (*i.e.*, excluding Sundays) was twenty-six, the same as last year.

During the first three months of 1935 the total amount of electricity generated by authorised undertakers was 4,699 million kWh, as compared with the revised figure of 4,270 million kWh for the corresponding period of 1934, representing an increase of 429 million kWh, or 10 per cent.

	1934. kWh. (millions).	1935. kWh. (millions).	Increase per cent.
January	1,536	1,714	11.6
February	1,343	1,478	10.0
March	1,391	1,507	8.3

A New E.A.W. Branch

The Mayor (Ald. J. R. Edgecombe) presided over a crowded meeting in Bournemouth Town Hall on April 8th, when it was decided to form a local branch of the Electrical Association for Women. Mr. Llewelyn Atkinson stated that, while industry had progressed, household work remained as it was 100 years ago. Only an electrical policy could remedy that fact. Miss Caroline Haslett explained the Association's objects and Miss Phyllis Atkinson, who proposed the formation of a Bournemouth branch, was elected chairman.

E.P.E.A. Functions

The Electrical Power Engineers' Association (London South Eastern Section) held a dinner-dance at Anderton's Hotel, Fleet Street, on April 5th. Mr. F. E. Hockley (chairman) presided over 150 members and friends, and proposed the loyal toast. The Mayor of Woolwich proposed "The Association," which was responded to by the president, Mr. C. Cooper.

The Northern Division held its annual dinner on April 6th at Manchester. About 270 members and guests were present, and the function was presided over by the chairman of the Division, Mr. Sarvent. The toast of "The Association" was proposed by Mr. N. Hefford, Leeds City electrical engineer. The president, Mr. Cooper, in replying, made some reference to the growing feeling of dissatisfaction which was being made manifest in the supply industry with regard to salaries. The industry was very prosperous, and it was not unreasonable to suggest that the staffs should participate in this prosperity. The toast of "The Guests and Ladies" was proposed by Mr. Sarvent, and Mr. G. A. Cheetham, chairman, North-Western Centre, I.E.E., responded.

Electricity in the Coal Industry

That the depressed state of the coal industry could be remedied with the help of electrical engineers was a view put forward by Major D. H. Thomas, president of the South Wales branch of the Colliery Managers' Association, at the annual dinner of the West Wales branch of the Association of Mining Electrical Engineers held at Swansea on April 6th, with Mr. W. I. Tanner (branch president) in the chair. In proposing the toast of "The Association" Major Thomas said that the co-operation of the Association and of the colliery managers would definitely be of benefit to the industry. For years the colliery manager had been hampered by the high cost of production, and he thought that electrical engineers could alter that. The toast was responded to by the chairman. "The Town and Trade of Swansea" was proposed by Mr. J. H. Evans, Alderman T. W. Hughes, J.P., Deputy-Mayor, replying.

The Tramways and Light Railways Congress

The annual congress of the Tramways, Light Railways and Transport Association is to be held at Llandudno on June 5th and 6th.

The Regulation of Communications

A course of lectures on "The International Regulation of Radio and Cable Communication," will be delivered at the London School of Economics on Fridays, May 3rd, 10th and 17th, by Mr. S. H. Bailey, M.A., lecturer in the Department of International Relations at the School.

Mines Overwind Prevention Committee

The Secretary for Mines announces the publication of the report of the Departmental Committee appointed by him to inquire into the precautions against overwinding which are, or could be, taken when persons are raised or lowered in mine shafts. The report is on sale, price 9d. (by post 10d.), and may be purchased from the Stationery Office.

Appointments Vacant

Temporary electrical engineering draughtsmen for the Air Ministry.

Sales engineer for Canterbury Electricity Department.

Two plumber-jointers for the Ayrshire Electricity Board.

Costing clerk for Chichester Electricity Department.

Junior mains assistant for Darwen Electricity Department.

Cost accountant for Bedford Electricity Department.

(See our classified advertisements.)

Our Personal Column

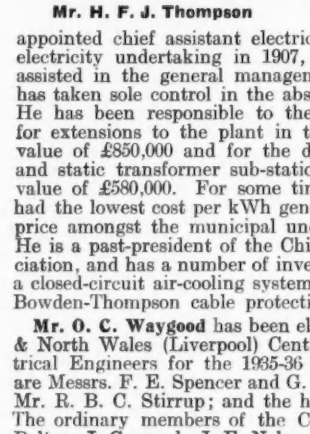
Electrical men are invited to keep readers of the "Electrical Review" posted concerning their movements

Mr. H. F. J. Thompson, whose appointment as general manager and engineer of the Battersea Borough Council electricity undertaking was announced in our last issue, was educated at the Central High School, Sheffield, and Sheffield University. He was with the Sheffield Electric Light & Power Co. from 1894 to 1899, and gained experience in electricity supply, private plant installation, and the manufacture and design of electrical apparatus. From 1899 to 1900 he was assistant engineer and manager to Messrs. Moon, Loughlin & Co., Manchester, and in October of the latter year he was appointed mains superintendent to the South Metropolitan Electric Light & Power Co., and was in charge of the a.c. and d.c. distribution systems over an area of twenty-five miles. He was appointed chief assistant electrical engineer to the Battersea electricity undertaking in 1907, and since that date he has assisted in the general management of the undertaking and has taken sole control in the absence of the general manager. He has been responsible to the borough electrical engineer for extensions to the plant in the generating station to the value of £850,000 and for the design and erection of rotary and static transformer sub-stations and cable systems to the value of £580,000. For some time past the undertaking has had the lowest cost per kWh generated and the lowest average price amongst the municipal undertakings in the Metropolis. He is a past-president of the Chief Technical Assistants' Association, and has a number of inventions to his credit, including a closed-circuit air-cooling system for alternators, &c., and the Bowden-Thompson cable protective system.

Mr. H. F. J. Thompson

Mr. O. C. Waygood has been elected chairman of the Mersey & North Wales (Liverpool) Centre of the Institution of Electrical Engineers for the 1935-36 session. The vice-chairmen are Messrs. F. E. Spencer and G. K. Paton; the hon. treasurer, Mr. R. B. C. Stirrup; and the hon. secretary, Mr. W. Parry. The ordinary members of the Committee are Messrs. C. E. Bolton, J. Cormack, J. E. Nelson, and E. G. Taylor.

Mr. N. B. Coop, A.M.I.E.E., A.I.Mech.E., has been appointed general manager of British Electric Meters, Ltd., and of Leda Electric, Ltd. He has been a director of the former concern since its inception and a director of the latter company for the past five years. He is a member of several B.E.A.M.A. committees.



[*Lafayette*

Mr. N. B. Coop

Mr. J. Broadhurst, operation engineer with the Electricity Board for Northern Ireland, is taking up a position in South-East England under the Central Electricity Board. At a gathering of the staff of the Northern Ireland Board on April 4th he was presented with a settee by Mr. C. R. Westlake, the chief engineer.

Mr. B. Welbourn, chief engineer of British Insulated Cables, Ltd., is to have the honorary degree of M.Eng. of Liverpool University conferred upon him on July 6th, not May 24th, as stated in our last issue.

Mr. A. V. Drummond, of Messrs. White, Drummond & Co., has been appointed London director of the Consolidated Gas, Electric Light & Power Co. of Baltimore.

Mr. E. W. Jackson, A.M.I.E.E., F.C.S., deputy sales engineer of Hackney Electricity Department, has been elected president of the St. John Ambulance Brigade Officers' Club (Hospitallers' Club). Mr. Jackson has been associated with the St. John Ambulance Association and Brigade for twenty-four years.

Mr. J. S. Forster, electrical engineer to the Crook Urban District Council, has been appointed electrical engineer to the Seaham Harbour Urban District Council in succession to Mr. H. Adam, who, as reported in our last issue, has become chief electrical engineer to Coal & Allied Industries, Ltd.

Mrs. Rosalind Messenger, a sister of Miss Caroline Haslett, has been elected a member of the Bungay Urban District Council. Mrs. Messenger is a director and the secretary of the Bungay Electricity Co., Ltd., and Area Organiser for East England for the Electrical Association for Women.

Mrs. R. Messenger

Sir Montague Hughman was elected president of the Batti-Wallahs' Society for the ensuing year at the annual meeting held on March 28th. The members of the Committee are Messrs. A. E. Apps, G. M. B. Hilton, J. McCaffery, H. S. May, R. E. Mohring, and J. W. Porter. Mr. M. Whitgift remains hon. secretary and treasurer.

Like their fathers before them, **Messrs. Leslie C. Sharp** and **R. L. Graseby,** of Venner Time Switches, Ltd., have been elected to the Livery of the Worshipful Company of Clockmakers. The ceremony took place on Monday last.

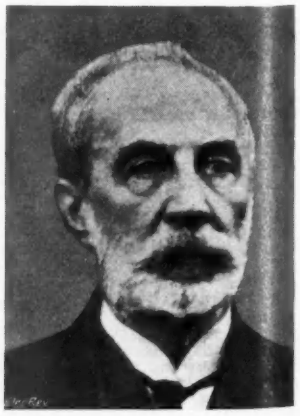
Mr. R. G. Widgery, deputy borough electrical engineer at Kingston-upon-Thames, has been appointed electrical engineer to the Shipley (Yorks) Urban District Council. Mr. Widgery received his education at Grays and East Ham and Battersea Polytechnics, and his practical training with the Grays U.D.C. Electricity Department and Taunton Corporation Electricity Department. He has held the positions of junior engineer in the Maidstone Electricity Department and charge engineer at Kingston, having been appointed deputy electrical engineer in 1926. He is an associate of the I.E.E. and a member of the American I.E.E.

Mr. R. G. Widgery

Sir Cyril Hurcomb, K.B.E., C.B., the secretary of the Ministry of Transport, has accepted the invitation of the Council of the Institute of Transport to become president of the Institute for the ensuing year.

Obituary

Mr. Robert Sheddon Dobbie, who died on March 1st at Auckland, New Zealand, began his connection with electrical engineering more than fifty years ago. He commenced his apprenticeship with the Yorkshire Engine Co. in 1876, and from 1880 to 1883 he was engaged erecting machinery in India. He was with the United States Electrical Co. and the Akron (Ohio) Electric Co. until 1887, when he joined the Edison General Electric Co. In 1892 he became designing engineer to the G.E. Co. (U.S.A.) and was subsequently with the Westinghouse Co., of Pittsburgh. Mr. Dobbie returned to England in 1894, and was designing and construction engineer to the British Thomson-Houston Co. under the late Mr. H. F. Parshall, upon whose recommendation he joined Sir W. G. Armstrong, Whitworth & Co. as chief electrical engineer in the following year. In 1905 he joined the staff of Messrs. Rendel & Robertson, now Rendel, Palmer & Tritton (consulting engineers), as chief of the electrical department.



The late Mr. R. S. Dobbie

Corrosion Research. By G. W. Molle, B.Sc. (Eng.), A.M.I.E.E.

THAT the very elements of the complex subject of corrosion are unknown to some engineers was brought home to me recently while reading a book from the I.E.E. library on hydro-electric power. In connection with the effect of water-flow on pipes, the word "erosion" was included in the text, and a previous reader had marginally altered this quite incorrectly to "corrosion."

The main thing to avoid in dealing with corrosion troubles is any kind of reasoning by analogy. Because a certain cure has been found in one specific case, it will not necessarily apply successfully to another case; it may, on the contrary, even accelerate the corrosion. The main point that seems to be generally accepted now is that there are only two methods of preventing corrosion: Either the metal itself must be non-corrodible, or the metal must be protected by having superimposed upon it some surface which resists corrosion.

As regards the first method there is no known metal which cannot be made to corrode, given the right conditions, and special metals, such as staybrite steel and various alloys of aluminium have the drawback of being very costly.

Value of Beryllium

There ought to be some future for the metal beryllium for overhead line conductors; it is immensely strong, and remarkably resistant to corrosion. As I am writing this article during a sea voyage and I have not any data files available at the moment, I cannot produce figures, but I know that the Copper Development Association has collected a great deal of information on this interesting metal.

With regard to the second method, the essential point, which cannot be too strongly emphasised, is that before a surface film or coating is applied to any metal, the surface must be properly prepared and dried. If this is not done the paint, galvanising, or other treatment is merely waste of money. Repainting will not improve matters, for the corrosion will continue underneath the paint.

The preservation of a metallic surface is done by the "gel" or "scale" which forms on the surface within a few seconds of its exposure to the air. If the "gel" remains undisturbed, all is well. Several processes are available for securing this result, such as the use of special paints, metal-spraying, galvanising, sherardising, bonderizing and parkerizing, the last two being special products of the Pyrene Co.

Bonderizing is a method of preparing the surface of the metal to be treated, in such a way that the paint, finally applied, is bonded to the metallic surface. A special chemical solution, it is claimed, actually changes the character of the surface to a highly rust-resistant, non-metallic base. The process takes from six to ten minutes, in a heated tank, and can be carried out by any workman of ordinary skill. Degreasing is done by trichlor-ethylene. The bonderizing solution is maintained at 210 deg. F. during the operation.

Parkerizing is a process whereby the surfaces of iron and steel are converted by chemical means into phosphates, these being insoluble in water and permanent in air. The articles to be treated must be degreased and all scale removed. The operation is carried out in a heated bath of special chemical solution. After about fifteen minutes hydrogen is vigorously given off, and gradually abates after about sixty minutes. Particles of iron have been dissolved, and replaced by phosphates from the solution. No additional coating of any other material is required, and none of the physical properties of the metal is changed.

The recently-issued "Second Report of the Corrosion Committee, 1934," should be studied by those interested in this subject, as should also the *Journal* of the Institute of Metals.

In 1930, I placed together in a glass jar several samples of overhead line conductor, each about six inches long. These were of plain hard-drawn copper, copper-cored steel, steel-cored copper, stranded-aluminium, and galvanised and tarred stranded steel. Some of the samples were solid, some round-stranded, and some segmental-stranded.

There were thus numerous dissimilar metals in contact. The glass jar admitted light and air, and was exposed for three years on a London balcony. It was half-filled with a strong, but not saturated, solution of common kitchen salt, and this was allowed to evaporate under normal conditions of sun and air. The jar was then left dry for a while, after which the process was repeated. These severe conditions were extremely favourable to corrosion, and the object was to discover qualitatively the effect on the various conductors. The strands were not bedded down tightly on the central steel in the case of steel-cored conductors as would occur in a conductor under tension.

The aluminium conductor practically disappeared within two months. In fairness to aluminium it must, of course, be pointed out that the conditions were such as would never be encountered in practice, and it is only necessary to recall that the entire British grid, and many hundreds of miles of line elsewhere, are constructed of aluminium.

Copper Stands Up Well

None of the copper conductors was corroded after three years. Within an hour or two of the first start of the experiment, a surface patina had formed which remained permanent. No galvanised core was corroded.

The most surprising result was that observed in the case of the galvanised and tarred steel-stranded conductor. This had actually lain about on the writer's desk for some months prior to the experiment, and was already pitted with rust. After three years' alternate wetting and drying with salt solution, and contact with other metals, no additional corrosion was observed. The "life" of steel conductors has varied in practice from two to three up to fifteen or twenty years. I believe that, if properly galvanised and well tarred, a stranded-steel conductor can be erected with perfect safety in any salty atmosphere, such as we have in Great Britain at any distance from the sea.

Financial Section

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Changes, Transactions in Stocks and Shares

New Companies Registered

William M. Betts, Ltd.—Private company. Registered April 6th. Capital, £100 in £1 shares. Objects: To carry on the business of electricians, mechanical engineers, manufacturers and workers of, and dealers in, electricity, &c. The subscribers are:—W. M. Betts, 260, Lower Addiscombe Road, Croydon; and A. C. Spencer, 258, Lower Addiscombe Road, East Croydon. W. M. Betts is the first and permanent governing director. Registered office: 51, Leslie Park Road, Croydon, Surrey.

Seal Electric Agencies, Ltd.—Private company. Registered April 6th. Capital, £1,000 in £1 shares. Objects: To carry on an agency for the import, export, purchase and sale of electrical plant, &c. The first directors are: H. R. A. Reed, 47, East Drive, Carshalton Beeches, and two others. Secretary: Hamilton Smith. Registered office: 7, Edward Street, Westminster, S.W.1.

W. T. Botten & Co., Ltd.—Private company. Registered April 1st. Capital, £100 in £1 shares. Objects: To carry on the business of motor, electrical and wireless and television engineers, dealers in motor cars and electrical accessories, &c. The first directors are: W. T. Botten, 25, Cyprus Avenue, Church End, N.3; and C. A. Chapman, Fairways, Banstead Road, Banstead, Surrey. Registered office: Woodside Works, Woodside Lane, N. Finchley, N.12.

K. G. H. Equipment, Ltd.—Private company. Registered April 3rd. Capital, £200 in 5s. shares. Objects: To make and assemble water-softening apparatus; to carry on the business of merchants, manufacturers, electrical engineers and contractors, &c. The subscribers are: H. G. de W. Newman, "Dymple," Tewkesbury Terrace, New Southgate, N.11 (secretary); and E. Waterson, Chitterman House, Cross Bush Road, Felpham, Bognor.

Electrical Centre, Ltd.—Private company. Registered April 6th. Capital, £100 in £1 shares. Objects: To carry on the business of electrical and general engineers and contractors, manufacturers of and dealers in appliances for cleansing, heating, lighting, power and radio, &c. The subscribers are: A. J. Key, 41, Norbury Crescent, Norbury, S.W.16; and C. Collieson, 58, Culverden Road, Balham, S.W.12. Solicitors: William Sturges & Co., Caxton House, Westminster, S.W.1.

Television Centre, Ltd.—Private company. Registered April 6th. Capital, £100 in £1 shares. Objects and other particulars similar to Electrical Centre, Ltd.

Lighting Centre, Ltd.—Private company. Registered April 6th. Capital, £100 in £1 shares. Objects and other particulars similar to Electrical Centre, Ltd.

Pellumetric, Ltd.—Private company. Registered April 2nd. Capital, £1,000 in £1 (500 5 per cent. participating preference and 500 ordinary). Objects: To carry on the business of electricians, mechanical engineers, suppliers of electricity, &c. The subscribers are: O. A. Derry, 2, Lymbourne Close, Belmont, Surrey; and C. G. Mant, 139, Witham Avenue, Cheam, Surrey. C. G. Mant signs documents as director. Registered office: 27, Curzon Street, W.1.

Gwent Radio Relay Service, Ltd.—Private company. Registered April 1st. Capital, £100 in £1 shares. Objects: To construct and maintain wireless signal stations for the reception or distribution of radio telephone signals or waves, &c. The

directors are: J. W. C. Robinson, House of Green Ginger, Hinchley Drive, Esher, and four others. Registered office: Bush Lane House, Cannon Street, E.C.4.

W. A. T. Signs, Ltd.—Private company. Registered April 3rd. Capital, £1,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in electrical signs, electrical goods, apparatus and equipment, electric lamps, &c. The directors are: J. Tee, 50, Mersham Drive, N.W.9, and two others. Registered office: 1-4, Stratford Mews, Wigmore Street, W.1.

Witcomb & Blackwell, Ltd.—Private company. Registered March 30th. Capital, £2,500 in £1 shares. Objects: To carry on the business of manufacturers of or dealers in electrical equipment, wireless telegraphy and television apparatus, &c. The directors are: F. L. Witcomb (permanent managing director), 55, Dulverton Road, Leicester; and J. S. Blackwell, 72, Beechfield Avenue, Birstall, Leicester. Secretary: F. Blackwell, 72, Beechfield Avenue, Birstall, Leicester.

Bursiem's Patents, Ltd.—Private company. Registered March 30th. Capital, £10,000 in 8,500 6 per cent. participating preference shares of £1 each and 20,000 deferred and 10,000 ordinary shares of 1s. each. Objects: To carry on the business of electricians, mechanical engineers, wireless manufacturers, household and domestic appliance manufacturers, &c. The subscribers are: T. C. Meldrum, 13, Copthall Avenue, E.C., and two others. Secretary: T. S. Meldrum.

Novo Radio (1935), Ltd.—Private company. Registered March 28th. Capital, £1,000 in £1 shares. Objects: To adopt an agreement, dated February 20th, 1935, with W. Black, junr., to purchase from him the entire stock, &c., of Novo Radio-Electric. Ltd. (in voluntary liquidation), and to carry on the business of manufacturers of and dealers in radio and television apparatus, radio-gramophones, &c. The first directors are: W. Black, junr., 3, The Drive, Longbenton, Northumberland; and Lt.-Comdr. H. Thorman, R.N. (retd.), Rose Bank, Corbridge, Northumberland.

Epoch Reproducers, Ltd.—Private company. Registered April 1st. Capital, £500 in £1 shares. Objects: To carry on the business of manufacturers, importers and exporters of and dealers in sound and speech reproducers, television and cinematograph apparatus, &c. The first directors are: A. L. Michael, Box Hill House, Reigate Road, Betchworth, Surrey; and E. W. Harris, 1, Lancelot Avenue, North Wembley. Registered office: Aldwych House, Aldwych, W.C.2.

John McClure, Ltd.—Private company. Registered April 1st. Capital £5,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in wireless and television apparatus, gramophones, &c. The directors are: J. E. McClure, Warren House, Warren Road, Ickenham, Middlesex, and two others. Solicitors: Boyce, Edwards & Sheppard, 14, Stratford Place, W.1.

Viceroy Radio & Television, Ltd.—Private company. Registered April 2nd. Capital, £100 in £1 shares. Objects: To carry on the business of wholesalers and retailers of and dealers in electric incandescent lamps and electrical accessories and goods of all kinds in connection with wireless telegraphy, telephony and television, &c. The directors are: J. Pearl, 34, Armitage Road, Golders Green, N.W.11, radio engineer; and S. King, 159, Malpas Road, Brockley, S.E.4, secretary. Registered office: 118, Euston Road, N.W.1.

Rayal Radio Co., Ltd.—Private company. Registered April 4th. Capital, £100 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in wireless transmitting and receiving apparatus and electrical components, &c. The directors are: S. A. Wood and Mrs. A. M. Wood, both of 5, Buckingham Road, Woodford, Essex. Registered office: 5, Buckingham Road, Woodford.

Returns of Electrical Companies

S. P. Catterson & Sons, Ltd.—Two notices of the appointment of H. D. Bell, of 53. New Broad Street, E.C., as (1) receiver and manager on March 22nd, 1935, under powers contained in "Z" mortgage debentures dated September 18th, 1934 (2) receiver on March 25th, 1935, under powers contained in "B" mortgage debentures, dated December 30th, 1893.

Weston-super-Mare and District Electric Supply Co., Ltd.—Satisfaction in full on March 25th, 1935, of £35,000 4½ per cent. first mortgage debenture stock secured by trust deed dated October 29th, 1903, and registered October 31st, 1903, and of £2,500 first mortgage debenture stock secured by an acknowledgement dated December 31st, 1910 (supplemental to trust deed dated October 29th, 1903), and registered January 21st, 1911.

Clifford & Snell (Eng.), Ltd.—The nominal capital has been increased by the addition of £3,750 beyond the registered capital of £1,250. The additional capital is divided into 3,000 ordinary shares of £1 each and 3,000 deferred shares of 5s. each.

Escott Brothers, Ltd.—The nominal capital has been increased by the addition of £5,000 beyond the registered capital of £2,000. The additional capital is divided into 1,500 ordinary and 3,500 7½ per cent. cumulative preference shares of £1.

Barbados Electric Supply Corporation, Ltd.—Capital, £100,000 in £1 shares. Return dated December 24th, 1934. All shares taken up. £53,051 paid. £41,949 considered as paid. Mortgages and charges, nil.

Eagle Wireless Supply Co., Ltd.—Capital, £2,000 in £1 shares. Return dated December 12th, 1934. 990 shares taken up. £990 paid. Mortgages and charges, nil.

Insular Electric Glowlamp Works, Ltd.—Capital, £5,000 in £10 shares. Return dated December 28th, 1934. 100 shares taken up. £20 paid. £980 considered as paid. Mortgages and charges, nil.

Metropolitan Rediffusion Services, Ltd.—Issue on March 28th, 1935, of £200 debentures, part of a series already registered.

Julius Sax & Co., Ltd.—Capital, £10,000 in 3,000 7½ per cent. preference shares of £1 and 35,000 ordinary shares of 4s. Return dated December 28th, 1934. 2,650 preference and 18,000 ordinary shares taken up. £5,051 paid on 2,650 preference and 12,005 ordinary shares. £1,199 considered as paid on 5,995 ordinary shares. Mortgages and charges, nil.

Hodin, Ltd.—Capital, £2,000 in £1 shares. Return dated November 24th, 1934 (filed January 7th, 1935). Two shares taken up. £2 paid. Mortgages and charges, nil.

George R. Lee & Co., Ltd.—Debenture dated March 28th, 1935, to secure £200, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: Alice Medway, 17, Quantock House, Lynmouth Road, N.16.

Tamworth District Electric Supply Co., Ltd.—Particulars filed of £50,000 debentures authorised March 27th, 1935, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £30,000.

Phonoradio, Ltd.—Memorandum of deposit dated March 19th, 1935, charged on the company's estate, right, title, and interest in land comprised in a building agreement, relating to Cool Oak Estate, Hendon, to secure all moneys due or to become due from the company to Barclays Bank, Ltd.

Sign Transformer Co., Ltd.—Satisfaction in full on March 27th, 1935 of debentures dated January 17th, 1934, and registered January 19th, 1934, securing £1,000.

Broadcast Relay Service, Ltd.—Satisfaction in full on or before March 21st, 1935, of trust deed dated July 22nd, 1933, and registered July 24th, 1933, securing £150,000 debentures and premium of 5 per cent.

C. C. A. (Central Cables & Accessories), Ltd.—Satisfaction in full on March 19th, 1935, of debentures dated April 16th, 1934, and registered same date, securing £300.

Chiswick Electricity Supply Corporation, Ltd.—Satisfaction in full on or before March 14th, 1935, of trust deed dated December 8th, 1908, and registered December 21st, 1908, securing £100,000 4½ per cent. mortgage debenture stock.

Neon Manufacturers, Ltd.—Further charge on benefit of certain contracts and agreement for hire of chattels, and the company's undertaking and other property, present and future, including uncalled capital, dated March 28th, 1935 (supplemental to mortgage debenture dated Februay 15th, 1935) to secure £750. Holders: Tudor Investment Trust, Ltd., 84, Temple Chambers, Temple Avenue, E.C.4.

Lystan Products, Ltd.—Particulars filed of debentures not exceeding £500, authorised March 8th, 1935, charged on the company's undertaking and property, present and future, including unpaid capital, the amount of the present issue being £100.

Sign Transformer Co., Ltd.—The nominal capital has been increased by the addition of £1,000 in £1 shares beyond the registered capital of £100.

City Notes

Associated Electrical Industries, Ltd., held its annual meeting on April 4th, Sir Felix Pole (chairman) presiding. In presenting the reports and accounts (Elec. Rev., March 29th, p. 472), the chairman said that the output of the various factories of the group was greater than in recent years, and orders received during the year, as well as orders in hand at December 31st last, were considerably larger than those for 1933. At home, the principal orders received by the Metropolitan-Vickers Electrical Co., Ltd., were from the Manchester and Belfast Corporations for large turbo-alternator sets, and from the Fulham Corporation for two 75,000-kVA transformers, which would be the largest they had yet manufactured, each weighing 110 tons. The London Passenger Transport Board was now experimenting with a six-coach train fitted with their special metadyne control equipment. This was a new departure in railway electrification practice. The Southern Railway also ordered from them some additional rolling stock equipment. So far as overseas business was concerned, important orders were received from many countries, but the largest volume of overseas business came from South Africa. The Victoria Falls and Transvaal Power Co. ordered four 33,000-kW turbo-alternator sets and a 20,000-kVA synchronous condenser, which was the fifth condenser they had supplied to the Power Co. From various South African mines they received orders for a large number of winding equipments. With regard to Russia, however, their anticipations were not realised, and they received only a few small orders from that country, due to the fact that the Russian Government was not placing orders abroad for electrical gear. They hoped, however, that this year would witness a change in that respect. Among the work actually completed in the factories last year was the 105,000-kW turbo-alternator for the Battersea power station of the London Power Co., and the large order for induction motors of a special design for electric locomotives for the Hungarian State Railways. Good progress was made with traction apparatus for the Polish State Railway electrification. Orders received during the first three months of the current year were appreciably higher than for the same period of last year, and included electric locomotives for South Africa, and waterwheel alternators of the largest diameter ever built by the company, which were destined for New Zealand. The contract for the electrification of a section of the Central Railway of Brazil had been signed by the Brazilian Minister of Transport. Employment in the group's factories was on a substantially higher level than it had been during the past two or three years. They now had over 30,000 employés, as against 26,000 a year ago. Referring to the growth in the consumption of electricity in this country, the chairman said there was an increase last year of 14 per cent., and to meet the prospective demand on the power stations of the grid system, the Central Electricity Board had authorised the purchase of additional plant. He anticipated a steady, regular placing

of orders, in view of the fact that the use of electricity was bound to go on increasing. Also the electrification of all suburban railways in and around London and other large cities could not be postponed indefinitely. For all these developments the companies of their group were ready. With regard to the Jubilee celebrations, all over the country the companies of the A.E.I. group would be carrying out floodlighting schemes. In London the B.T.H. Co. would floodlight the Horse Guards Parade, the Admiralty Arch, and the County Hall. The Ediswan Co. was installing floodlighting for the National Gallery as well as a number of other buildings. The first National Electrical Convention would be held at Bournemouth in June and would be an event of supreme importance. He believed there would be continuance of good trade, but they must not overlook the fact that in many countries conditions were still unstable, and that quotas, barter agreements, exchange restrictions, &c., must inevitably impede export business. They must be thankful, therefore, that they had a satisfactory volume of orders on hand, and that the dimensions of incoming business during 1935 would maintain a good load on the factories.

A. Reyrolle & Co., Ltd., held their annual meeting on April 4th, Sir A. N. L. Wood (chairman) presiding. In presenting the report and accounts (ELEC. REV., April 5th, p. 511), the chairman said that the turnover showed an increase on the previous year's volume resulting in a small additional profit. The value of orders received was also greater than in the previous year and although it was too early to draw any definite conclusion as regards the current year, the volume of orders booked since the beginning of January had been maintained at a satisfactory level. They were able during 1934 to employ on the average a larger number of workpeople, and although there was a falling-off in the numbers employed during the first two months of 1935 they hoped that the total would again increase as the year advanced. Last year he drew attention to the growth throughout the country of electricity supply and forecast that this would mean a steady loading-up of the systems of electricity undertakings and would, he hoped, result in a continuous demand for their main manufactures. The reports which had appeared during the past few weeks had shown that this increase in output of electricity had continued during 1934, largely encouraged by the progressive activities of the Central Electricity Board. The growth of the areas of supply of the electricity undertakings and their interconnection with the main distribution lines of the Central Board had introduced many problems which were new to this country. The service duties which electrical machinery, and in particular switchgear, was called upon to perform under these conditions required new and highly technical considerations, the solution of which their staff had undertaken in a satisfactory way. In this connection the short-circuit testing plant which they installed some years ago, and which was being enlarged, had been of invaluable service not only to them in the field of research but also to many of their customers. This work entailed a continuous expenditure of time and money, and they were proposing to provide a further sum of £20,000 for development expenditure. They could claim that every year they gave greater service, both technically and in the articles they supplied; this entailed extra cost which could be offset only in some measure by the introduction of improved methods of manufacture. Co-operation with their foreign licensees continued to be beneficial, but the amount of effective business in the United States had been very small. Export sales during 1934 were satisfactory and still represented a considerable proportion of their total turnover. The business obtained by J. H. Holmes & Co. during the year also showed an improvement. Regarding the Parolle Co., this company had not yet closed its first accounts; its main interest at the moment was the holding of shares in C. A. Parsons & Co. The latter company was busy and the directors were satisfied that from every point of view the closer connection between the two companies would prove profitable. They looked forward to the help in future of the Parolle Co. to obtain an interest in large contract work. With regard to the reference to Armstrong College in the report, in addition to the College providing them with recruits who had taken the College degrees, Dr. Thornton had given them valuable advice in their research and technical investigations, and for some years past they had subscribed £250 per annum to the Electrical Engineering Department. They had now been asked by the College authorities to covenant to pay this subscription for a period of seven years so that the College could claim a repayment of income tax.

The Electric Supply Corporation, Ltd., reports a net revenue for 1934 of £59,360, as compared with £64,585 for 1933, to which is added £27,949 brought in, £1,292 profit on sale of investments and £96 transfer fees, making £88,699. The final ordinary dividend is 7½ per cent., less tax, making 11 per cent. for the year. The total distribution is the same as for 1933, but is payable on an amount increased by a 30 per cent. capital bonus. The balance carried forward is £28,233. The report states that arising out of the sale of the Chelmsford and Totnes undertakings there was left in the repairs, renewals and depreciation fund an amount which, together with the sum of £43,073 written off the capital account in 1922, was more than sufficient to provide for the requirements of the Corporation's remaining undertakings at Dumbarton, Falmouth, and St. Andrews. The sum of £23,000 has, therefore, been transferred to the general reserve. At the end of the year 11,608 consumers were connected to the mains. The energy supplied during the year totalled 20,326,048 kWh, an increase of 19 per cent. The figures were reduced through the sale of the Chelmsford, Totnes and Petersfield undertakings (6,504 consumers and 4,940,000 kWh), but supplemented by the inclusion of the Burgess Hill undertaking and a great increase in the supply for power. Meeting: April 17th.

The Chiswick Electric Supply Corporation, Ltd., reports a profit of £39,560 for 1934, as against £31,872 for 1933, of which £6,500 is reserved for income tax and £7,083 is to be refunded to consumers. The amount brought in is £7,834, and it is proposed to pay a final dividend of 5 per cent., making 11 per cent. for the year (unchanged), and to carry forward £6,311. The Aberystwyth local authority has served the Corporation with a notice of its intention to purchase the Aberystwyth undertaking on December 20th next. The purchase price is to be determined, failing agreement, by arbitration. The provisional agreement with the Brentford and Chiswick Corporation for the sale to it of the Chiswick undertaking for £281,375 has become binding on both parties.

The General Electric Co., of New York, reports that orders received during 1934 were $183,660,303, an increase of 29 per cent. over the preceding year, and sales billed (representing shipments) were $164,797,317, an increase of 21 per cent. The net sales were $164,797,317, against $136,637,268, and the net income was $19,726,043 ($13,429,738), to which is added an earned surplus brought in of $117,621,616. Four quarterly cash dividends of 15 cents per share were paid on the special stock and four quarterly cash dividends of 15 cents each were declared on the common stock. The board voted on December 28th last to retire all of the outstanding special stock on April 5th, 1935, at $11 per share and accrued dividends. The earned surplus carried forward is $111,333,680.

The Notting Hill Electric Lighting Co., Ltd., reports a profit for 1934 of £68,555, as compared with £63,738, to which is added £19,700 brought in, making £88,255. After deducting debenture interest, &c., it is proposed to pay a final ordinary dividend of 7.0646 per cent., and to carry forward £15,163. If these recommendations are approved, the employé co-partners will be entitled to receive a bonus of 15 per cent. on their salaries and wages for the year. Electricity purchased in bulk totalled 18,252,725 kWh, as compared with 16,333,738 kWh in 1933, and the sales were 15,334,200 kWh, against 13,222,278 kWh. The number of consumers supplied increased from 14,033 to 15,226, and the kW connected from 24,998 to 26,750. Meeting: April 16th.

The Telephone Manufacturing Co., Ltd., reports a profit for 1934 of £18,043, as compared with £16,168 for 1933. It is proposed to maintain the dividend for the year at 2½ per cent., to place £10,000 to reserve, and to carry forward £6,272, against £9,688 brought in. The report states that negotiations for the introduction of some measure of rationalisation into the telephone industry were successfully concluded towards the end of 1934, and as a result the whole of the factory was well employed at the present time on contracts secured at an economic price. This arrangement will be of considerable benefit to the company during 1935 and onwards. Meeting: April 29th.

Telephone Properties, Ltd., reports a net profit for 1934 of £36,427, as against £39,270 in the preceding year, to which is added £8,751 brought in. It is proposed to pay a final ordinary dividend of 3 per cent., making 5 per cent. for the year (against 6 per cent.), and to carry forward £11,366. The report states that a reduction in the rate of dividend declared by the Venezuelan subsidiary company for 1934 has been approximately offset by the rate of the sterling exchange which has had the effect of increasing the receipts shown in the accounts. Meeting: April 15th.

Simms Motor Units, Ltd.—Speaking at the annual meeting on Tuesday the chairman (Mr. E. B. Ridsdel) said that there had been a satisfactory turnover in magnetos and other products during 1934. Their lighting equipment business had also been satisfactory and they were now developing a smaller dynamo for commercial vehicles which would undoubtedly mean a further increase in turnover. The company's subsidiary, the Standard Insulator Co., had shown considerable headway.

The Rangoon Electric Tramway & Supply Co., Ltd., reports a net profit for 1934 of £62,073, as against £57,295 for 1933, to which is added £22,837 brought in. It is proposed to pay a final ordinary dividend of 14 annas, making 20 annas for the year, free of Indian tax (same), and to carry forward £24,077. At an extraordinary meeting to be held in Rangoon on April 25th, a proposal will be submitted for increasing the capital to £1,000,000, by the creation of 200,000 shares of £1.

The Anglo-Portuguese Telephone Co., Ltd., has announced a final dividend of 5 per cent. on the ordinary shares, making 8 per cent. for 1934 (same), a final dividend at the rate of 5 per cent. per annum on 123,908 new ordinary shares (making 8 per cent. per annum), and a dividend of 8 per cent. actual on the "A" ordinary shares.

Companies to be Struck Off the Register.—The names of the following companies will be struck off the Register at the expiration of three months unless cause is shown to the contrary: Almeida Accumulators, Ltd.; Magneto & Accumulator Co. (Birmingham), Ltd.

The Ever Ready Trust Co., Ltd., has announced final dividends of 4 per cent., on the ordinary and deferred shares, making 7 per cent. for the year. For the previous fifteen months, dividends of 8½ per cent. were paid on both classes of shares, equal to 6.8 per cent. per annum.

The Mid-Cheshire Electric Supply Co. is offering ordinary and preference shareholders 50,000 new £1 ordinary shares at 32s. 6d. per share. The shares will rank for the 1935 dividend at the declared rate, calculated on paid-up amounts.

Edmundson's Electricity Corporation, Ltd.—The results of the operations of the Edmundson group of companies during March, as compared with the corresponding month of 1934, show an increase of 9 per cent. of kWh sold.

The Great Northern Telegraph Co., Ltd., of Denmark, proposes to distribute a total dividend and bonus of 20 per cent. for 1934, including the 5 per cent. already paid.

The Adelaide Electric Supply Co., Ltd., has announced an interim dividend of 5 per cent., actual, free of tax, on the ordinary stock (unchanged).

The West London & Provincial Electric & General Trust, Ltd., is paying a final dividend of 3½ per cent., making 5 per cent. for the year (against 4½ per cent.).

Murex, Ltd., has declared an interim dividend on the ordinary shares of 10 per cent. For the previous year the interim rate was 15 per cent., but on a smaller capital.

Joseph Lucas, Ltd., have declared an interim ordinary dividend of 2½ per cent., less tax (same).

The North Somerset Electric Supply Co. has declared a dividend of 7 per cent. for 1934 (same).

Stocks and Shares

Tuesday Evening.

THE financial atmosphere is deemed to be clearer than it was, and the Conference this week at Stresa is anticipated by Stock Exchange markets without apprehension. It must be said that, equally, no tangible results are expected to materialise as a result of the talk at Isola Bella. The Budget is to be opened, of course, next Monday, and the Chancellor's announcement is awaited with comfortable feelings. In advance, the theory is that Mr. Chamberlain will keep to the side of safety first, that he will produce a Budget free from exciting or disturbing items, and will frame his estimates with a due regard for caution. The curious cross currents leave prices very much where they stood previously. London Passenger Transport "B" stock has put on 10s., and the Board's "C" stock at 99 is 2 points higher. In the list of Central Electricity issues no changes have occurred. The decrease in the unemployment figures is a decided bull point for industrial stocks and shares.

Ontario and the Power Companies

No little interest and a good deal of protest has been aroused by the decision of the Premier of Ontario, Canada, to void certain contracts for the supply of electric power entered into by the Ontario Hydro-Electric Power Commission. The matter was carried into Parliament last week, and Sir Waldron Smithers, the Conservative member for Chislehurst, and a member also of the Stock Exchange, asked the Dominion Secretary whether he would approach the Canadian Government in order to see whether, in the interests of Canada, steps could be taken to disallow the proposed legislation. The Dominion Secretary treated the inquiry with the usual Government reserve. The official attitude of the Canadian Government is one of reticence.

The Ontario Government has carried a step further the determination of the United States President to lay increasing burdens upon the shoulders of utility companies. Reference has been made to the matter here several times during the past few weeks. Prices of American utility stocks and shares have declined in value, though to no great extent. The bonds and shares of the Canadian companies are held fairly largely in this country, and if the Ontario Government persists in its present policy, Canadian utility companies are likely to be treated very coolly if they ever come again to this country for money to finance industrial projects. British Columbia Electric Railway 5 per cent. preference stock is down 9 points.

Electricity Supply Shares

The Electric Supply Corporation has declared a dividend of 7½ per cent. on its ordinary shares, as against 7 per cent. a year ago. Both rates make 11 per cent. for the completed twelve months, but the interim dividend six months ago was ½ per cent. less than that in the corresponding period. The company distributed a scrip bonus of 30 per cent. last May, so that the dividend now declared is payable on £99,500 additional capital. The price of the shares remains unchanged at 56s. 3d., showing a yield at that price of nearly 4 per cent., making allowance for inclusion of the dividend in the price. County of London shares are a shade harder at 54s. 6d., North Metropolitans are a firmer market, West Gloucestershire ordinary strengthened to 87. In the foreign list, the price of Palestine "A" ordinary shares has been moving about in erratic fashion. After touching 12s., it fell back to 10s. 3d., and rallied to 11s. 3d.—premium in all cases. British Power and Light at 25s. show a gain of 1s. 3d. Victoria Falls ordinary hold their substantial gain at 7 5/16.

Cable and Wireless

The report of the Telephone Properties Company, which is interested largely in Venezuela, is not a particularly cheerful document. The dividend is reduced from the previously paid 6 per cent. to 5 per cent. for the year, and until the bolivare becomes stabilised, it would appear as though the company's profits are likely to be severely affected by the exchange. The price of the ordinary shares is dull at 15s., the 8 per cent. preference are quoted at 25s., and the 6 per cent. first mortgage debenture at 105½. Cable & Wireless stocks are inert, the "A" ordinary being 10s. down, the other stocks showing no alteration. Globes are equally quiet. The Great Northern Telegraph report had no effect upon the price of the shares, which remains at 38. Marconi Marines, quoted ex dividend on Monday in this week, have recovered the deduction of 1s. less tax. American Telephone & Telegraphs at 108 are up 1, and Internationals are ½ up at 7¼.

Manufacturing and Equipment

Johnson & Phillips shares, and Siemens ordinary, have been a good market, in anticipation of dividend increases in both cases. Johnson & Phillips paid 5 per cent. for last year and Siemens 4 per cent. It is hoped that there will be increases in each case. Ever-Readys are flat at 21s. 6d. Amongst the higher priced shares Enfield Cables have recovered to 95s., and British Insulated, after being down to 73s., rallied to the previous price of 75s. Associated Electrical Industries ordinary are a good market at 25s. Arons have given way to 3¾. Telegraph Condenser shares are in request, and the price is better at 27s. 6d.

Share List of Electrical Companies

Home Electricity Companies.

	Nom.	Dividend 1934.	Dividend 1935.	Price. Apl. 9	Rise or Fall.	Yield. £ s. d.
Bournemouth and Poole	1	15	15	76/3xd	—	3 18 9
Brompton Ordinary	1	7	7	33/6	—	4 3 7
Charing Cross Ordinary	1	7	7	33/9	—	4 3 0
Chelsea	1	7	7	33/6	—	4 3 7
City of London	1	7½	7½	36/6	—	4 2 2
Clyde Valley	1	7	8	41/–	—	3 18 2
County of London	1	10½	10½	54/6	+6d.	3 17 1
Edmundson's 7% Pref.	1	7	7	35/–	—	4 0 0
Elec. Dis. Yorkshire	1	9	9	46/–	—	3 18 3
Elec. Supply Corporation	1	11	11	56/3xd	+1/–	3 18 5
Kensington Ordinary	1	7	7	33/6	—	4 3 7
Lancs Light and Power	1	7½	7½	36/–	—	4 3 4
London Electric	1	7	8	37/6	—	3 14 8
Metropolitan	1	10	10	50/6	+6d.	3 19 3
Midland Counties	1	7	7	35/6	—	3 19 0
Mid. Elec. Power	1	8	8	51/3	—	3 2 6
North Eastern Electric Ordinary	1	6	6	31/–	+6d.	3 17 5
Do. 7% Pref.	1	7	7	34/–	—	4 2 4
Northampton	1	10	10	52/6	—	3 16 4
Notting Hill 6% Pref.	10	6	6	14½	+½	4 2 9
North Met. Elec. Ordinary	1	10	10	58/3	—	3 8 9
Do. do. 6% Pref.	1	6	6	30/6xd	—	3 18 8
St. James and Pall Mall	1	7	8½	33/6	—	4 18 6
Scottish Power	1	8	8	40/–	—	4 0 0
South London	1	7	7	35/6	—	3 17 9
Westminster Ordinary	1	7	7	33/6	—	4 3 7
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	26/3	—	5 14 1
Yorkshire Elec.	1	8	8	42/6	—	3 15 5

Public Boards.

Central Electricity, 1950–70	Stock	5	5	115	—	4 7 2
Do. 1955–75	„	5	5	117	—	4 5 6
Do. 1951–73	„	4½	4½	111	—	4 1 1
Do. 1963–93	„	—	3½	101	—	3 9 6
London & Home Counties, 1955–75	„	4½	4½	114	—	3 19 0
London Passenger Transport, A	„	—	4½	121½	—	3 14 0
Do. do. B	„	—	5	124½	+½	4 0 4
Do. do. C	„	3	—	99	+2	3 0 7
West Midlands Joint Elec. 1948–68	„	—	5	115	—	4 7 0

Telegraph and Telephone.

		1932	1933			
American Tel. & Tel.	$100	9	9	108	+1	8 6 9
Anglo-Am. Tel. Pref.	Stock	6	6	117½	—	5 2 2
Do. Def.	„	1½	1½	27	—	5 11 2
Cable & Wireless 5½% Pref.	„	2¾	2¾	82	—	3 7 1
Do. A. 7½% Ord.	„	Nil	Nil	16	—½	—
Do. B. Ord.	„	Nil	Nil	5¾	—	—
Globe Tel. & Tel. Ord.	10	Nil	2½	11½	—	2 3 7
Do. do. Pref.	10	6	6	13½	—	4 10 7
Great Northern Tel.	10	20	20	38	—	5 5 3
Marconi-Marine	1	10	7½	31/3xd	+9d.	4 16 0
Oriental Telephone Ord.	1	12	12	3⅛	—	*3 12 5

Home and Foreign Trams, Etc.

Anglo-Arg. Trams First Pref.	5	Nil	Nil	2/–	—	—
Do. do. 2nd Pref.	5	Nil	Nil	1/6	—	—
Do. do. 5% Deb.	Stock	Nil	Nil	5	—	—
British Electric Traction Df. Ord.	„	5	5	945	—	—
Do. do. Pref. Ord.	„	8	8	165	—	4 17 0
Brazil Traction	100	—	—	8¾	—¼	—
Brit. Columbia Elec. Rly. Pfc.	Stock	5	5	93½	—9	5 7 0
Mexican Light Common	100	Nil	Nil	1½	—	—
Do. 7% Pref.	100	7	7	3	—1½	—
Do. 1st Bonds	$500	5	5	39½	—	—
Victoria Falls Ord.	1	15	20	7 5/16	—	2 14 9
Yorkshire (West Riding)	1	2½	5	28/9	—	3 9 9

Manufacturing Companies.

Aron Electricity Ord.	1	10	10	62/6	—⅛	3 4 0
Assoc. Elec. Ord.	1	4	6	25/–	—	4 16 0
Do. Prf.	1	8	8	37/–	—	4 6 4
Babcock & Wilcox	1	9	6	44/6	+3d.	2 14 0
British Aluminium Ord.	1	5	7½	30/3	—	4 19 2
British Insulated Ord.	1	5	15	75/–	—	4 0 0
Brush Ord.	Stock	Nil	Nil	37½	—	—
Callender's	1	15	15	3½	—	4 5 9
Do. 6½% Pref.	1	6½	6½	32/6	—	4 0 0
Crompton Parkinson Ord.	5/–	22	12½	35/6	—	1 15 0
Do. 8% Pref.	1	8	8	36/3	—	4 8 5
Edison-Swan 1st Pref.	1	7½	7½	27/6	—	5 9 1
Electric Construction	1	Nil	Nil	15/–	—	—
Enfield Cable Ord.	1	25	20	4¾	+⅛	5 5 3
English Electric	1	Nil	Nil	6/9	—	—
Do. do. Pref.	1	Nil	Nil	13/3	—	—
Ever Ready	5/–	35	35	21/6	—⅛	8 2 10
Ferranti Pref.	1	7	7	29/–	—	4 16 7
G.E.C. Pref.	1	6½	6½	31/3	+⅛	4 3 2
Do. Ord.	1	8	8	48/3	—	3 6 7
Henley's	1	30	30	6¾	—	4 9 0
Do. 4½% Pref.	5	4½	4½	5¾	—	3 16 8
India-Rubber Preferred	1	—	5½	1¼xd	+5d.	4 17 9
Johnson & Phillips	1	5	5	31/9	+6d.	3 3 0
Siemens Ord.	1	6½	4	1⅛	+⅛	3 15 4
Telegraph Construction	£1	Nil	Nil	1⅛	—	—

* Dividends paid free of Income Tax.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and all subsequent proceedings will be taken.

1933

16209. "High-frequency coil with adjustable inductance value." H. Vogt. June 21st, 1932. (Cognate application 16210/33.) (425296.)

22308. "Protective switching systems on electric trolley buses." British Thomson-Houston Co., Ltd. August 9th, 1932. (425404.)

24795. "Alternating-current oscillatory circuits." L. E. Ryall. September 7th, 1933. (425308.)

25023. "Wireless and like receivers." J. Robinson. September 9th, 1933. (Cognate application 8326/34.) (425412.)

25278. "Anodes for electrolytic baths." Dr. H. Leiser. September 12th, 1932. (425317.)

25492. "Variable inductances and variably tunable circuits incorporating the same." Telefunken Ges. für Drahtlose Telegraphie. September 14th, 1932. (425481.)

25633. "Incandescent electric lamps." B. B. Fenn and B. B. Fenn, Ltd. September 15th, 1933. (425485.)

25770. "Traffic-control signals." Automatic Electric Co., Ltd., and J. H. Taylor. September 18th, 1933. (425551.)

25777. "Decomposition and composition of pictures particularly in television." E. Traub. September 18th, 1933. (425552.)

25797. "Thermionic-valve amplifiers." Electric & Musical Industries, Ltd., A. D. Blumlein and H. A. M. Clark. September 18th, 1933. (425553.)

25987. "Devices for the rectification of alternating current." British Thomson-Houston Co., Ltd. September 20th, 1932. (425421.)

26956. "Cooling and insulating dielectric liquids for use in electrical apparatus." Westinghouse Electric & Manufacturing Co. October 8th, 1932. (425324.)

27036. "Electrically heated elements." R. P. Fraser. October 2nd, 1933. (425556.)

27794. "Methods of spot welding." British Thomson-Houston Co., Ltd. October 8th, 1932. (425371.)

29002. "Systems for relaying and distributing radio programmes." R. E. H. Carpenter and P. P. Eckersley. October 19th, 1933. (425375.)

29732. "Telephones." A. Graham & Co., Ltd., and C. H. Vaughan. October 26th, 1933. (425558.)

30220. "Electric-arc convertors." General Electric Co., Ltd., and C. C. Garrard. October 31st, 1933. (425491.)

30790. "Electrical fuse-gear." P. London. November 6th, 1933. (425492.)

30801. "Electric discharge devices." General Electric Co., Ltd., and L. C. Jesty. November 6th, 1933. (425493.)

30942. "Electric signalling systems." Siemens Bros. & Co., Ltd., and C. J. B. Douglas. November 7th, 1933. (425561.)

31078. "Loud speakers." Earl Manufacturing Co., Ltd., and J. G. Elliott. November 8th, 1933. (425562.)

31144. Relief devices for containers of liquid-immersed electrical apparatus." General Electric Co., Ltd., and H. Fisher. November 8th, 1933. (425423.)

31435. "Snap-action electrical switches." J. A. Crabtree. November 11th, 1933. (Cognate application 19357/34.) (425424.)

33128. "Electric condensers, of the variable capacity type." H. W. Sullivan, Ltd., and W. H. F. Griffiths. November 27th, 1933. (425329.)

34591. "Electrical condensers." Dubilier Condenser Co. (1925), Ltd., December 10th, 1932. (425332.)

36709. "Electrodes of electric discharge tubes." J. Kilpatrick & Son, Ltd., J. Orr, and A. W. Forrest. December 30th, 1933. (425564.)

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3238. "Telephone instrument circuits." Siemens Bros. & Co., Ltd., and E. R. Wigan. January 31st, 1934. (Addition to 372400.) (425566.)

4029. "Enclosed surface-cooled electric motors." Ateliers de Constructions Electriques de Charleroi. February 7th, 1933. (425429.)

10804. "Control apparatus for regulating transformers." Siemens-Schuckertwerke Akt-Ges. and J. W. Rissik. April 10th, 1934. (425510.)

16968. "Devices used in radio receivers for improving reception." A. Schwienbacher-Horat. July 24th, 1933. (425339.)

17507. "Short-wave radio apparatus." Marconi's Wireless Telegraph Co., Ltd. August 31st, 1933. (425571.)

17523. "Electron-discharge device." Hazeltine Corporation. January 30th, 1933. (Divided out of 35549/33.) (425340.)

18103. "Electrolytic condensers." Telegraph Condenser Co., Ltd., and F. C. Stephan. June 19th, 1934. (425342.)

19125. "Mercury-vapour generators." British Thomson-Houston Co., Ltd. July 1st, 1933. (425344.)

19492. "Electric high-frequency signal systems." British Thomson-Houston Co., Ltd. July 1st, 1933. (425572.)

20160. "Mercury switches." P. Katsch Ges., E. Meyer and A. W. Isenthal. July 8th, 1933. (425345.)

21792. "Fastening devices for luminous electric discharge tubes." Quarzlampen-Ges. July 25th, 1933. (425445.)

21793. "Electric discharge tubes." Quarzlampen-Ges. July 28th, 1933. (425576.)

22901. "Electrical condensers." Dubilier Condenser Co. (1925), Ltd. August 8th, 1933. (425347.)

22982. "Aerial arrangements suitable for broadcasting purposes." Telefunken Ges. für Drahtlose Telegraphie. August 8th, 1933. (425448.)

32798. "Electric converting apparatus." British Thomson-Houston Co., Ltd. November 15th, 1933. (425399.)

33466. "Systems for electrically measuring the thickness of metallic walls, sheets, and the like." A. Loewenstein. November 21st, 1934. (425586.)

33507. "High-frequency coil with adjustable inductance value." H. Vogt. June 6th, 1933. (Divided out of 425296.) (425468.)

Trade Mark Applications

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from April 3rd:—

Amplec. No. 556500. Class 6. Electric washing machines. No. 558131. Class 18. Electrically heated washing boilers in the nature of coppers.—Amplec, Ltd., Grange Lane, Accrington, Lancs.

John Bull. No. 557119. Class 8. Dial measuring gauges.—British Indicators, Ltd., 4-5, West Smithfield, E.C.1.

Atmos. No. 558324. Class 8. Electric batteries (not for medical purposes).—General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.

Nelcos. No. 558093. Class 13. Electric lamps (ordinary).—Nox Electric Lamp Co., Clarence Road Works, Hunslet, Leeds.

Novera. No. 556594. Class 18. Electric fires.—Ferranti, Ltd., Hollinwood, Lancs.

Ocobind. No. 558273. Class 40. Adhesive tape composed principally of india-rubber.—Ioco Rubber & Waterproofing Co., Ltd., Netherton Road, Anniesland, Glasgow.

Guttaroid. No. 558381. Class 50. Insulating compositions made principally of pitch.—W. T. Glover & Co., Ltd., Trafford Park Manchester.

Sponac. No. 558421. Class 50. Separators of wood for accumulators.—Oldham & Sons, Ltd., 36, Hyde Road, Denton, near Manchester.

Hull Trades Exhibition

THE stands of the Hull Corporation Electricity Department at the recent Hull Trades Exhibition were very prominent and involved several new features. Separate small stand exhibits were included. These comprised special equipment for the baker, including a large baking oven, dough and cake mixer, together with small utensils, practical demonstrations of all modern hairdressing equipment, including an under-the-basin water heater, electric all-insulated hair drier, permanent-waving machine, massage and vibro apparatus, and special mirror illuminations, and a special stand for the farmer, laundryman and dairyman, including two types of electrode boilers for steam raising. In conjunction with these sterilising chests and a bottle-washing machine were demonstrated. Another feature of the stand was sterilising and hospital equipment, this being a portion of a large equipment supplied to a local hospital, and comprised glove and instrument steriliser, hot and cold water sterilisers of 10-gal. capacity each, drum steriliser and bowl steriliser. Additionally a large display was made of all modern fittings, vacuum cleaners, and washing machines. A separate stand also displayed water-heating apparatus. Cooking demonstrations were conducted in a room set apart and equipped specially as a kitchen. A further novel feature was a room set on one side for the poultry farmer and gardener. Under the section devoted to the poultryman were shown two groups of week-old chicks, one being under a 250-chick brooder with variable heat and one group being housed in a small bin heated by a radiant reflector fire suitably erected to bathe the area in heat. An incubator with eggs was shown, together with drinking-water trough warmer and conversion units for existing incubators and oil brooders. During the course of the exhibition the birds made excellent progress. In the gardeners' section a small greenhouse and frame were installed, the former being warmed by electrical tubular heaters and the latter by means of soil heating cable. A stand was also set aside for the fish fryer and contained a full size three-pan range having three 20 in. by 21 in. pans together with two chip servers and two fish covers, all electrically heated; also a potato washing and peeling machine of the sudless pattern, capable of dealing with 40 lb. of potatoes.

Part of the Hull Electricity Department's stand

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Aberdeen.—Houses (90), Grampian Place and Tullos Place; A. B. Gardner, city architect.

Ayrshire.—Ante-natal clinic, Girvan, electrical work; W. Reid, county architect, Ayr.

Bedford.—School, London Road (1,020 places), for Borough E.C.; S. C. George, secretary.

Berkshire.—Extensions, Windsor boys' schools, including laboratories, for County E.C.; director of education, Reading.

Birkenhead.—Estate development, Overchurch Road; W. M. & M. W. Shennan, architects.

Birmingham.—Factory, Bourneville, for Cadbury Bros., Ltd. Factory, Amington Road, Tyseley, for Wilmot Breedon, Ltd. (£20,000), with electrical work; B. Whitehouse & Sons, builders, Monument Road, Edgbaston. Garage (150 omnibuses), Liverpool Street, Bordesley, for the Birmingham Tramway and Omnibus Committee.

Blaydon-on-Tyne.—R.C. school (280 places); P. J. Stienlet, architect, 5, Saville Chambers, Newcastle-on-Tyne.

Brierley Hill (Staffordshire).—Houses (442), Dudley Fields site; R. H. J. Comber, surveyor, Albion Street.

Bristol.—Houses (70), Bedminster Estate (£20,020); John Knox (Bristol), Ltd. Houses (66), Horfield Housing site; city engineer, Housing Department, 51, Prince Street. Houses (36), Portway; E. A. W. Poole & Son, Ltd.

Buckinghamshire.—Boys' grammar school, Slough, for County E.C.; county architect, Aylesbury.

Bushey Heath.—Telephone exchange for H.M. Office of Works, London, S.W.1.

Cannock.—Houses (60), five parishes; R.D.C. surveyor.

Cardiff.—Houses (125), clearances; city engineer.

Catterick Camp (Yorks).—Ordnance buildings for the Royal Army Ordnance Corps (£26,000); G. Dougill & Sons, builders, Darlington.

Cheshire.—School, Meadway, Ashton-on-Mersey, for County E.C.

Cheshunt.—Houses (28); U.D.C. surveyor.

Chesterfield.—Houses (25) and bungalows for aged persons; Rollinson & Son, architects, 10, Corporation Street. Extensions to Chatsworth Wagon Works for Wagon Repairs, Ltd. Extensions to printing works, Station Road; W. Edmunds, Ltd.

Chester-le-Street.—Extensions to Isolation Hospital for the Joint Hospital Board; E. M. Lawson, architect, 19, Ridley Place, Newcastle-on-Tyne.

Chorley.—Houses (62); Pius A. Baines & Son, Ltd., builders. Preston.

Colchester.—Senior school, Sheepen Farm; Duncan Clark & Beckett, architects.

Coventry.—Houses (206), Bell Green; E. H. Ford, city engineer.

Darlington.—Houses (100); burgh surveyor.

Deal.—School (360 places), Mill Road, for Borough E.C.; director of education.

Derby.—Extensions to technical college (£22,013), for Borough E.C.; Corporation Building Works department.

Durham.—School, Horden, for County E.C.; F. Willey, county architect, 34, Old Elvet, Durham.

Eccles.—Houses (126), Leamington Road; T. H. Mitchell, Ltd. Extensions to works, Cawdor Street; Ermen & Roby, Ltd.

Edinburgh.—Houses (108), Iona Street; E. J. MacRae, city architect. Two schools and extensions to Albion Road School, for City E.C.; director of education.

Essex.—Senior schools, Brightlingsea and Lawford, for County E.C.; J. Sargent, director of education, Chelmsford.

Faringdon.—Houses (64); Public Works Construction Co., Ltd., Swindon.

Glasgow.—Development of Garscadden Estate; Kyle & Frew, surveyors.

Halifax.—Senior schools, Ovenden, electrical and heating work, for Borough E.C.; D. T. Lloyd Jones, borough engineer.

Hampshire.—School, Millbrook, for County E.C.

Harpenden.—Cinema, Luton Road, for Austral Cinemas, Ltd.; T. H. Johnson & Son, architects, Doncaster.

Hereford.—Development of Tapsley Court Estate; Bettington & Son.

Hoddesdon.—Houses (78), Stortford Road Estate; U.D.C. surveyor.

Hull.—Cinema, Sunningdale Road; City & Suburban Cinemas (Hull), Ltd.

Ilford.—Houses (52), Mighel Avenue; P. G. Ashton & Son. Houses (34), Staines Road; E. Glenny & Son, Ltd. Houses (20), Stradbroke Grove; Hurstwell & Co. Jam factory, Woodford Avenue; P. Connor, Loughton, Essex.

Ilkeston.—Two schools, for E.C.

Irish Free State.—(Naas, Co. Kildare).—Hospital, Naas, for County Board of Health, Naas; V. Kelly, architect, 87, Merrion Square, Dublin.

Leeds.—Houses (260), Westfield Estate (£74,273); Wm. Thompson & Sons. Houses and flats, Hawkesworth Wood Estate, &c; Tarran Industries, Ltd.

Leek.—Swimming baths, Ball Haye; U.D.C. surveyor.

London.—(Greenwich).—Tenements, Victoria Road (£26,400); borough enigneer. (Hackney).—Tenements, Warburton Square (£108,500); L.C.C. architect. (Islington).—Tenements, North Avenue (£50,000); L.C.C. architect. (Poplar).—Houses, Gaselee Street area (£34,000); L.C.C. architect. (St. Pancras).—Houses, Chalton Street area (£46,500); L.C.C. architect. (Southwark).—Tenements, Ayliffe Street area (£136,000); L.C.C. architect.

Luton.—Houses (50); borough surveyor.

Manchester.—Schools, Brownley Green and Sharston, for E.C. Extension to Town Hall; J. Gerrard & Sons, Ltd., Swinton.

Mansfield Woodhouse.—Houses (100), Park Avenue and Park Hall Road, for the Economic Housing Estates, Ltd.; Calvert, Calvert and Jessop, architects, 18, Low Pavement, Nottingham.

Middlesbrough.—Houses (172), for Emerson-Tollesby Building Estate Co. Houses, Stockton Road; S. Coates, Ltd., builders, Langbaurgh Place, North Ormesby.

Mitcham.—Extensions to Wandle Joint Hospital (£50,000); town clerk.

Monmouthshire.—Secondary school, Aberbargoed, for County E.C.; J. Bain, county architect, Newport.

Nailsworth (Glos).—Houses (20); U.D.C. surveyor.

Newburn-on-Tyne.—Houses (46); J. Weatherby, surveyor.

Newcastle-on-Tyne.—Houses (183), Daisy Hill Estate; R. G. Roberts, housing architect, 18, Cloth Market. Bus depôt, Gallowgate, for United Automobile Services, Ltd., Darlington. Factory for Smith's Potato Crisps (1929), Ltd., Brentford, Middlesex.

Newport (I.O.W.).—Cinema, Pyle Street and Town Lane (£20,000), for Odeon Theatres, Ltd.

North Shields.—Additions to Collingwood Infants' School for E.C.; Rigby & Appleton, builders.

Oxford.—Two cinemas, George Street and Cowley Road; Union Cinemas, Ltd.

Plymouth.—Houses (191) and flats, St. Budeaux Estate (£67,362); Building and Public Works Construction Co., Ltd., Swindon. Development of Lipstone Estate; Major R. M. Coles. Factory for Courtaulds, Ltd.

Reigate.—Telephone exchange, Church Street, for H.M. Office of Works, King Charles Street, London, S.W.1.

Richmond (Yorkshire).—Houses (74); R.D.C. surveyor.

Rotherham.—School, Eastdene Housing Estate; St. Bede's Catholic trustees.

Rothwell (Yorkshire).—Houses (30), Lofthouse Housing Estate; F. Hartley, architect, Council Offices, Rothwell, near Leeds.

Rowley Regis.—Houses (150); A. & J. Mucklow, builders, High Street, Blackheath, Birmingham.

Rustington (Sussex).—Hotel, Broadmark Estate (£40,000), for Sidney Jones.

Salford.—School (900 places), Lancaster Road, Pendleton, for E.C.

Scarborough.—Houses (46) and shops, Cross Street, and school, Northstead Estate; borough engineer. Garages for the Station Garages (Scarborough), Ltd.; Jones & Rickaby, architects, 102, Westborough.

Sittingbourne.—Cinema, High Street, for East Kent Cinemas, Ltd.

Slaithwaite.—Rebuilding Commercial Hotel (electrical work); Abbey & Hanson, architects, 11, Cloth Hall Street, Huddersfield.

Somerset.—Senior school, Wells, for County E.C.; director of education, Taunton.

Southend-on-Sea.—Extensions to St. Mary's School, Prittlewell; O. H. Cockrill, architect, Weston Road.

South Shields.—Houses (168), Mowbray Road; R. Brown & Sons, Ltd., builders, 24, Lord Street. Block of flats, Sunderland Road, for T. B. Carr; J. H. Morton & Sons, architects, Fowler Street.

Staffordshire.—Public offices, Eastgate Street, Stafford, electrical and heating work, for C.C.; H. L. Underwood, clerk, Stafford. Senior girls' school, Croft Street, Tamworth, for County E.C.; director of education, Stafford.

Stanley (Co. Durham).—Bus station, library and swimming bath; A. Routledge, U.D.C. surveyor.

Stockport.—Houses (172), Adswood Hall Farm Estate; borough surveyor.

Stockton-on-Tees.—Houses (121), William Street and York Street; borough engineer. Extensions to sheet metal works for the South Durham Steel and Iron Co., Ltd.

Stone (Staffordshire).—Houses and bungalows; G. S. Challacombe, U.D.C. surveyor.

Strood (Kent).—Houses (22); D. P. Terry, R.D.C. building surveyor, Frindsbury Hill.

Sundon (Luton).—Houses (962) and shops and flats, Leagrave Road, electrical work; Excel Homesteads, Ltd., Thornton Heath, Croydon, Surrey.

Surrey.—School (240 places), Coulsdon, for County E.C.; secretary, Kingston-on-Thames.

Swindon.—Houses (21), Crickdale Road; A. J. Colborne.

Taunton.—Inland Revenue offices, Billet Street; Roberts & Willman, architects, 2, Hammet Street.

Tunbridge Wells.—Police court and police and fire stations (£42,812); borough surveyor.

Twickenham.—Houses (66), Nelson Road; borough surveyor. Flats (200), Ravensbourne Road; W. Boyd Scott, architect.

Wakefield.—Houses (100), Lupset Estate; P. Morris, architect, Town Hall. Cinema, Kirkgate, for Associated British Cinemas, Ltd.; W. H. Glen. Cinema, Snapethorpe Estate; Savoy Picture House (Huddersfield), Ltd. Maternity hospital, Manygates Park; L. Ives, city surveyor, Town Hall.

Wallsend-on-Tyne.—Houses (59), Rosehill Estate, for the Northern Homes and Estates, Ltd., Blackett Street, Newcastle-on-Tyne; W. Riddle, architect, 53, Denham Terrace, Wallsend-on-Tyne.

Warrington.—Houses (62), Orford Green; R. & S. Smith. Extensions, including out-patients' department at the infirmary (£25,000); secretary. Shopping centre with market hall, shops and arcade, Market Gate; J. Y. Hughes, borough surveyor. Extensions, St. Peter's schools, Ashton Street; Church managers.

West Ham.—Nurses' home and maids' quarters, Whipps Cross Hospital, Leytonstone; W. L. Jenkins, borough engineer.

West Riding.—Schools, South End, Thorne and Moorends, for County E.C.; director of education, Wakefield.

Whickham-on-Tyne.—Houses, East Sunnyside Farm; W. Rutherford, builder, The Oaks, Sunniside.